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Electric Features of the Windsor Plant

IN THIS issue is an article which deals with some of the electrical features of the great Windsor (West Va.) station, the mechanical features of which were discussed last week. The not unusual arrangement of a double bus system is employed into which the great generators feed. To prevent some of the most serious risks of operating several large generators in parallel the bus is sectionalized by reactors. The switches controlling these protective devices are automatically interlocked in a rather novel manner with the generator switches, thus preventing the generators ever being put on the bus without the reactors in service, unless intentionally in some special case of emergency. Still further to protect against the danger of surges, really very serious in stations of large output, an oil-insulated condenser is connected with the bus to relieve sudden and abnormal electrical strains. Each of the great turbo-generators carries a direct-connected exciter big enough to supply two generators in a pinch. In addition to this a 250-volt exciter bus, arranged for the connection of all the exciters and all the machine fields, has been installed, running the full length of the station. A motor-generator set can feed into this general bus.

The auxiliaries for each turbo-generator are motor-driven at 550 volts, and each set therefore has its own three-phase transformer to feed these auxiliaries, stepping down the main supply from 11,000 volts. Beyond the main switch house the high-tension energy is delivered at two separate high-tension yards belonging to the two companies associated in the ownership of the station. Four high-tension feeder equipments are supplied from the high-tension transformers at 11,000, 25,000, 66,000 and 130,000 volts respectively. The transformers for the two latter voltages are wound so as to be interchangeable. All feeders are equipped with inverse-time-limit relays, while the transformers have definite time-limit relays, the settings for these being adjusted to the feeder necessities.

In the control room of the station one feature has been introduced which is both unusual and important. From this point can be read the temperatures of the transformers in the high-tension yards and also local temperatures at important points in the turbo-generators themselves. Besides this, an alarm system is installed to give warning of any interruption in the flow of the cooling water to the high-tension transformers. The system has clearly been worked out with a keen eye to the future, when the output of the station will rise to enormous figures and will be delivered over widely ramifying networks to great distances.

Saving Fuel and Boilers

IN THE present fuel situation even small economies in coal are worth considering, and when, together with material saving in actual fuel, come a lowered upkeep of the boilers and better steaming capacity it is clear that the matter rises to considerable importance. S. B. Applebaum's paper in the present issue is a thorough study of methods and results with respect to the treatment of feed water to obviate scale. Hard water, particularly of certain types, tends to form scale at a somewhat surprising rate. The effect of this is threefold. It lessens the efficiency of the fuel consumption, decreases the ultimate steaming power of the boiler, and tends to the rapid destruction of tubes. A coating of scale even up to a quarter of an inch (6.3 mm.), thick and nearly as hard as stone, may form in a few months' use of bad water, and such coatings have not been unknown in boilers of electric light plants. Such a non-conducting coating produces results that are unpleasantly obvious, and even when existing in such smaller quantity, scale produces serious loss from every standpoint. The actual loss in fuel depends, of course, upon the amount of scale, which is itself a function of the quality of the water and of care in treating it or cleaning the boilers.

The prevention of scale, either by chemical or mechanical means, the former being much the easier, has been found, as a matter of experience, to save anywhere from 5 to 20 per cent or more of the total fuel bill, to say nothing of the gain in lessened cost of repairs to the boilers—a very serious matter, particularly in the cases where boilers have to be hard pushed to carry over the peak of the load. Mr. Applebaum gives some very instructive data, especially with respect to locomotive boilers, in which it has been repeatedly found that the saving in boiler repairs is a large item, amounting in some cases to at least 5 per cent. The general remedy for scale is found in artificial softening of the water by chemical means, of which there are several available. Mr. Applebaum discusses at some length the actual methods employed, in their bearings on boiler economy, and shows what might have been anticipated—that the net saving is sufficient to pay richly for the installation of the water-softening plant wherever conditions which point to the free formation of scale exist. The actual net gain in coal, repairs and lessened cost of boiler cleaning amounts in the example given by Mr. Applebaum to some $2.50 per horsepower per year. Of course, the actual figures will vary considerably with the conditions and with the hardness of the water.

Efficiency of Electric Cooking

WITH the great awakening of interest in electric cooking comes a demand for better apparatus. In principle the use of electricity for heating purposes is at almost theoretically perfect efficiency. The difficulty is not in the conversion of electrical into thermal energy but in the utilization of the latter, and there is just as much opportunity for waste at this point as in any other form of heat utilization. In fact, electric heating has suffered in the past and is still occasionally suffering from a certain thick-headedness of the designer which results in an attempt to carry an outward resemblance to old-time inefficient gas and coal ranges into electric range design, often with somewhat disastrous results in the way of efficiency. Prof. R. G. Kloeffler's study of electric range efficiency is of very direct value in showing both the strong and the weak points of such apparatus as is now produced. From an experimental standpoint his task was a simple one. It consisted of measuring the input of energy at the heating unit and the output in heat obtainable therefrom. In practice the output was reckoned by heating water to approximately the boiling point, using in succession various types of utensils adapted to the purpose. The surface heating units on eight different electric ranges were thus tested, three units being of the inclosed-conductor type, four of the open-conductor type and one unclassified. The utensils used were of graniteware and aluminum, these being the materials which are in common use.

Now the notable thing in summing up these experiments is the generally low efficiency obtained. Very few figures for any utensil on any range ran over 50 per cent when starting with the heating unit and water at ordinary room temperature, showing that the chief fault in the electric range used in this way is ineffective heat insulation or no heat insulation at all. Certain experiments further prolonged so that the heat stored in the heating-unit utensils and their surroundings could be more fully utilized gave, of course, a higher efficiency; but the plain fact is that a heating unit made and used after the similitude of the gas range or the coal range is much less efficient than an electric heating device ought to be. Roughly, more than half the energy is wasted. The obvious moral is that by better design, and particularly by the use of thorough heat insulation and special utensils adapted to make the best of it, one could do electric cooking with very much less energy than is necessary on the ordinary commercial range. The cause of this fault, it seems to us, is not generally lack of designing skill on the part of the maker of the heating apparatus, but an unfortunate disinclination to break away from the bad precedents established by ranges of the older kinds. The chief requirement is that the electric heat should be applied as directly as possible with as small losses from conduction and convection as are obtainable. In practice these losses are generally much greater than they ought to be. In electric ovens, which have relatively very large surface, heat insulation is even more important than elsewhere in the range.

Professor Kloeffler's tests were made by giving to the ovens fixed input until the internal temperatures became steady. Three different final temperatures, corresponding roughly to a quick, a medium and a slow oven, were tried out. The results of these tests were particularly interesting and the details will well repay careful reading.

Output Coefficients for Small Direct-Current Motors

IN THE design of dynamo-electric machines of an already established type a question often arises as to the particular dimensions which should be adopted for intermediate sizes and ratings. If the dimensions are excessive, the machine when constructed is likely to be heavy and expensive for its output. If, on the contrary, the dimensions are chosen too small, the speed or efficiency may be unsatisfactory.

It is therefore very desirable to have guiding rules by which the principal dimensions of new sizes of machines can be laid down on a reasonable and scientific basis. In a general way, the output of a machine will be approximately proportional to the volume of the armature and to the rated speed, but the speed cannot be left open to final adoption after all the other particulars have been settled. In motor production the speeds of operation under rated load may indeed be divided into two or more groups, such as high-speed, low-speed and intermediate-speed types of motor; but in each of such groups the speed is expected to diminish with the size and output of the motor in some systematic way. Consequently the rating of any new motor will probably involve a definite associated rated speed, and the dimensions of the armature and field magnets must be such as to provide the assigned load and speed without undue weight, cost, heating or sparking.

The curves given in E. W. Kellogg's article in this issue supply information in convenient form for the design of a particular type of motor in intermediate sizes. Starting with a trial armature diameter, the designer determines the sizes and magnetic carrying power of the armature teeth and then adjusts the length of the armature core to provide the correct torque and speed at rated load. It is assumed that several designs will be attempted with slightly different armature diameters, so as to enable a proper selection to be made.

In order still further to guide the designer, a curve sheet is offered for arriving at a suitable starting diameter, having given the required output and speed.

What Shall We Do with Labor?

WAR'S wastage of labor means a loss to the industry which will have to be taken into account. The effect will be felt more acutely in those branches where labor is a large part of production cost than in, for instance, the central station, where it is relatively a small part. Nevertheless, no section will remain untouched by the growing independence of labor. Charles M. Schwab said a few days ago that the worker was to dominate the world. A more temperate statement is that of former Supreme Court Justice Hughes, a student of industrial relations accustomed to consider and weigh. Before the New York Bar Association last month he said: "Individual privilege [in the future] will have to show cause before a public to which old traditions are no longer controlling—a public trained in sacrifice—which will enforce its own estimate of the common right." And again he said: "The present ex-

ercise of authority over the lives of men will hereafter find its counterpart in a more liberal exercise of power over the conduct, opportunities and possessions of men."

Two theories are advanced as to the future of labor supply. One is that this country will absorb Europe's supply; the converse is that a new-born Europe will attract its sons and grandsons from our foreign shores. Either theory recognizes that labor will be in keen demand and that, like commodities, labor will tend to flow to those markets which promise the largest return. Electrical industries will need to attract and hold their workers against all outside bidders, either here or abroad.

Mr. Schwab and Justice Hughes had the courage to recognize the changing order. Narrow minds, however, will rail and rant, urge that capital prepare to fight for its position, and declare that no man shall dictate how they shall run their plants. Such minds are not changed by dissertations on the reasonableness of the new order, which decrees that the public good shall take precedence over private gain, that the public cares for the individual and demands that he shall have a voice in determining the conditions under which he works.

Those who question the accuracy of the judgment that warns against new conditions in the realignment of labor and capital will do well to heed the words of Secretary of Labor Wilson at the great loyalty labor meeting in New York on February 10: "In all the legislation to fix prices there has never been one line for the limitation of the earnings of workers." What we are concerned with in these historic times is not whether it is just or unjust to fix the wages of capital and to leave deliberately untouched the wages of labor; what we are concerned with is the overwhelming fact that this situation is here, it is unescapable, there is nothing to do but accept the problem and solve it.

And what of efficiency, now at a low mark in industrial plants? Education is the answer—education through participation in management regarding the factors which affect profits; education engendering responsibility for success of the industry, a realization that there can be no labor prosperity without industrial prosperity—a realization that will be turned into effective action by confidence that labor will get "its share" of the profits it helps to create. A long process, yes, but a necessary one.

Labor sells a service, capital buys a service. Seller and buyer continue to do business only when each is reasonably satisfied with the bargain. Far-seeing employers are ready to make sacrifice. So, too, are forward-looking labor leaders. The country demands that both sides look carefully to it that they be not misrepresented. Above all, let both be prepared for large concessions. In that direction lie peace and the country's good.

Motors in the Textile Industry

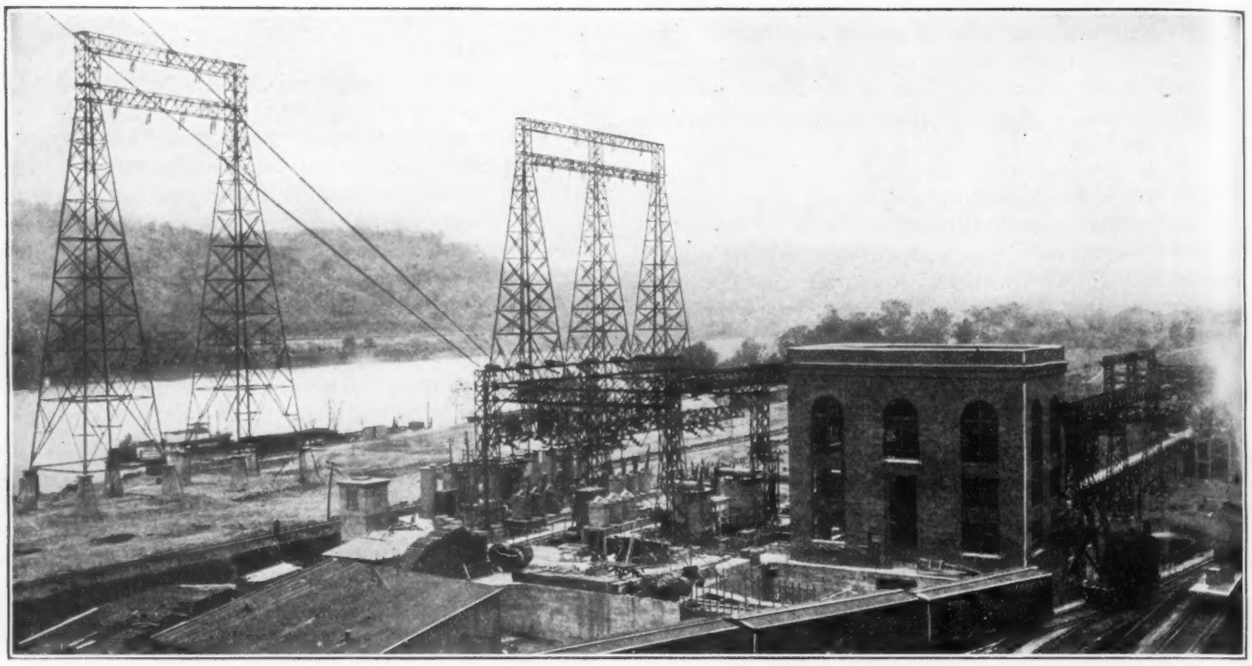
ANOTHER of Professor Clewell's capital articles takes up in the current issue the rapidly increasing use of motors in textile mills, an art which in its beginnings goes back very nearly five-and-twenty years, but which has been rapidly improved as conditions have gradually led to the adoption of more and more independent methods of motor driving. In the beginning the cotton industry clustered about water powers where motive power could be cheaply obtained. As the steam engine became more highly developed in efficiency and as mills outgrew their normal supply of water power and fell back upon steam auxiliaries, the waterwheel found relatively less and less use. In the forty years from 1870 to 1910 it had fallen from 60 per cent of the total to about 20 per cent. Steam power had increased from some 40 per cent to 60 per cent, and the remaining 20 per cent was furnished by electric power. It has been estimated that by 1920 the percentage of electric power will easily have doubled. In the earliest electrical mill drives the steam engines were replaced by fairly large motors employed for group driving. The steady tendency of late years has been more and more toward individual drive, which is easily employed in new mills and gives greater possibilities of power economy than have been afforded by the methods that it supersedes.

Probably the typical mill consists of a combination group and individual drive, the former for certain machinery operated, so to speak, in blocks, each consuming no very great amount of power in the aggregate; the latter for the heavier and more independent work. For mill work the induction motor is chiefly used, since for most classes of work unusual flexibility of speed regulation is not required. At the beginning of the art competition with direct-current machinery caused the building of induction motors with extraordinarily low speed variation, a tendency which has of late given way to more normal design. In a few places in mills motors of special type have to be employed on account of the presence of large amounts of dust and lint in the air, and in some cases because of troublesome vapors that arise.

Experience shows that the electric drive for this work has not only the usual advantages of facilitating a cheap supply of motive power but also leads to a larger and more uniform output on account of the better operating characteristics of subdivided motive power. There is every indication that the use of motor drive in mills is going to increase steadily, bringing the greater water powers into active use in this class of manufacturing and superseding not a few of the steam drives now in use.

The Coming Issues

ONE of the articles which will be presented next week will show the effect of wave form and frequency of a source of energy on the performance of mercury-vapor rectifiers. Mechanical features of the new power station of the New Bedford (Mass.) electric service company will also be described. This plant has some unusual coal-handling and boiler-room arrangements. Another article by Professor Clewell will be presented in that issue on the advantages and disadvantages of flywheel effect with certain classes of electrical drive. The possibility of utilizing flywheel effect to perform a useful function in preventing disturbances on supply lines which serve fluctuating loads will be discussed at length. Professor Kloeffler's analysis of electric range operation will be concluded next week and will contain the results of efficiency tests on a number of ovens.



Bulk Supply Generating Station at Mouth of Mine

Conclusion of Article on Jointly Owned and Operated Plant at Windsor, W. Va.—Description of the Electrical Features of the Station—Feeders and High-Tension Equipment

SOME of the broad aspects of the Windsor (W. Va.) bulk-supply generating station, which is jointly owned and operated by the American Gas & Electric Company and the West Penn Power Company, were brought out in the Feb. 9 issue of the ELECTRICAL WORLD. Among the subjects discussed were the natural facilities that influenced the building of a plant at this point, the proximity of an enormous market for energy, the high diversity factor of the load, and arrangements for making joint operation satisfactory. In addition, attention was called to the unusual indoor accommodations for fuel, the deep condenser pits required because of the seasonal change in river elevation, special construction of the economizers and other mechanical details. The article in the present issue refers to the electrical features of the station.

In the ultimate layout six 30,000-kw., 11,000-volt, three-phase, 60-cycle generators will be arranged for connection to a double bus system composed of a main bus and a reserve bus parallel to it. The main bus will be operated on the ring system, but the reserve bus will not at present, although space has been left to install the ring connection at a later date if it is thought advisable. For each station unit there is a bus unit so designed as to limit the possible interchange of power between bus sections to an amount well within the guarantee of the oil-switch manufacturers. Between each two bus sections there is a 5 per cent reactor, which may be placed in or taken out of the bus by opening or closing a reactor short-circuiting switch.

When the generators are paralleled on the bus they are separated by these current-limiting reactors. In this connection a novel automatic control arrangement has been worked out. The control circuit for operating the generator switch on the main bus and the reactor short-circuiting switch are electrically interlocked so that when the generator switch is closed the reactor switch is open and vice versa. This prevents generators being placed on the bus without reactors between them. Provision is made, of course, for independent operation of these switches when necessary. This arrangement of current-limiting reactors and switch gear also avoided sacrificing desirable voltage regulation and incurring undue expense. As a further protection against surges, a high-frequency absorber, which is in reality an oil-insulated condenser, has been installed to relieve un-

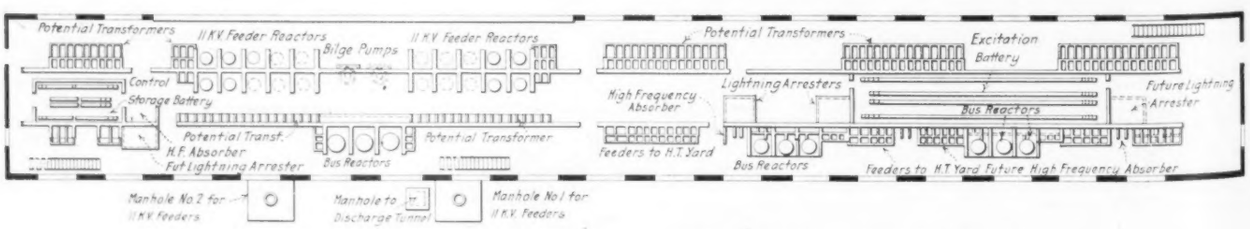


FIG. 1—REACTOR AND POTENTIAL-TRANSFORMER GALLERY OF SWITCH HOUSE

usual disturbances and strains upon the equipment of the station.

Control of all low-tension energy is centered in an operating room between the present generator room and the switchhouse (Figs. 3 and 4, Feb. 9 issue). The room occupies the space over the intake well and is supported on 6-ft. (1.8-m.) steel trusses which span the space between the turbine-room wall and the wall of the

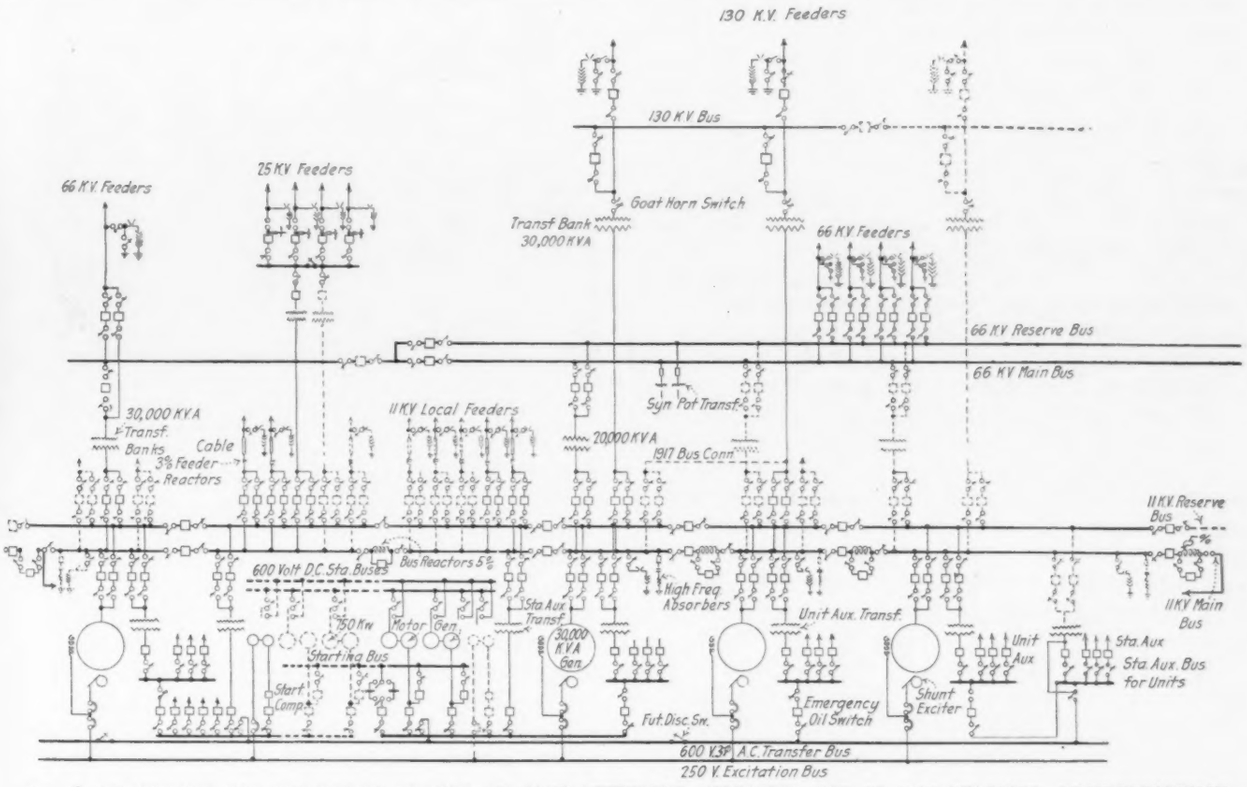


FIG. 2—PROVISIONS FOR DELIVERING ENERGY AT FOUR DIFFERENT VOLTAGES; USE OF BUS REACTORS, HIGH-FREQUENCY ABSORBERS AND DUPLICATE BUSES

switch house. The trusses do not interfere with access to the intake well, which is necessary to permit cleaning it at intervals. Being inclosed, the space occupied by the trusses has proved of still further value as a spacious conduit chamber for all lines leading to the switchboards in the operating room. By dividing the operating room horizontally with a floor it has also been possible to provide offices for the chief engineer and the load dispatcher on the second floor.

The 11,000-volt cables from the turbines are arranged for connection with 11,000-volt buses in the switch house through either of two 2000-amp. oil switches. The buses and switch-cell structures are on the turbine-room floor level. The reactors, potential transformers, current transformers, cable terminals, lightning arresters, switch gears and storage batteries, which are also in the switch house, are on the floor below. Beneath this lower floor are cable tunnels which extend

out into the high-tension switch yard, carrying power cables in fiber conduit laid in concrete and control cable in iron conduit on racks. The power-cable ducts have been so designed as to reduce the risk from burn-outs to a minimum and still to allow the cable to be easily accessible in case changes in arrangements are necessary.

Each turbine is provided with its own direct-connected exciter, the rating (210 kw.) of which is sufficient to carry two generators in an emergency, 140 kw. being required for the maximum field excitation of one machine. Further provision for emergency excitation was made by the installation of a 250-volt exciter bus running the full length of the station. Arrangements are made for connecting all machine exciters and all machine fields to this bus. The bus is also served by a 150-kw. motor-generator set, which was installed with the first two units. Space has also been reserved for an excitation storage battery which will be installed later. There is a Tirrill regulator on each machine exciter and on the separate motor-driven exciter which supplies the excitation bus.

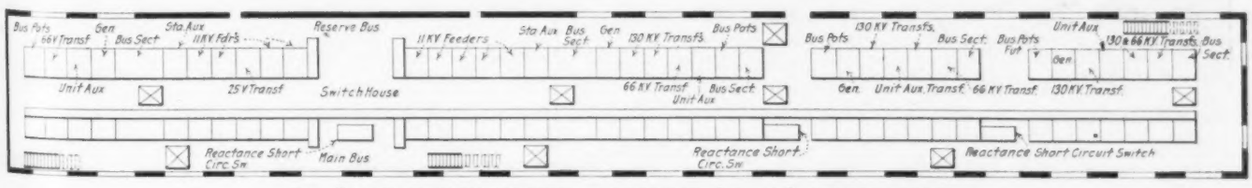


FIG. 3—OIL-SWITCH GALLERY OF WINDSOR (W. VA.) SWITCH HOUSE

Each generating unit is provided with an 1800-kva., three-phase transformer to step down the potential from 11,000 volts to 550 volts to drive the motors of its own auxiliary equipment. The electrical requirements

of auxiliaries attached to one unit are about 1500 kva. The stoker motors are not included in this aggregate since they are direct-current machines and are operated from 600-volt motor-generator sets which also supply cranes, hoists, automatic elevators and coal-mining equipment. Two separate 1800-kva. station auxiliary transformers, in addition to the one attached to each turbine, are operated from the 11-kv. bus section and supply motors about the station which are not directly connected with any particular unit. They also supply energy for operating the motor-generator sets which furnish energy for the direct-current auxiliaries.

FEEDERS AND HIGH-TENSION EQUIPMENT

From the switch house the energy is delivered to two separate high-tension yards owned by the West Penn Power Company and the American Gas & Electric Company respectively. The feeders leaving the station can be divided roughly into four groups, namely, 11-kv. feeders, which supply local industries; 25-kv. feeders, which supply a network of the West Penn system; 66-kv. feeders, which supply some of the lines of the American Gas & Electric Company; 66-kv. feeders, which will ultimately operate at 130 kv. and which serve a part of the West Penn system, and 130-kv. feeders, serving the longer lines of the American Gas & Electric Company. All of the feeders leaving the station are laid out on the radial system, arrangements being made for parallel operation of two lines in case of emergency. It is understood by the operators, however, that radial operation is preferred and that parallel operation is an emergency measure.

Each of the 11-kv. feeders is equipped with a 3 per cent current-limiting reactor. These reactors, like all other reactors in the plant, were not arbitrarily chosen but were selected to limit the current which might flow into a short to a value well within the rating of the smallest oil switch in the circuit.

All of the 66-kv. and 130-kv. transformers are wound so as to be interchangeable. Furthermore, the 66-kv. units are arranged so that they may be operated later at 130 kv. To provide further flexibility, arrangements have also been made for connecting together the 66-kv. buses in the high-tension yards of the two companies.

From the main 11-kv. bus the energy which is to be transmitted at 130 kv. leaves the station through 30,000-kw. banks of transformers, the low-tension switches for which are installed inside the station. No switches are provided on the low-tension side of the transformers in the high-tension yard. Here a high-tension transfer bus is provided, so that the load from any outgoing 130-kv. line can be distributed over other operating banks of transformers in case it is necessary to shut down one bank.

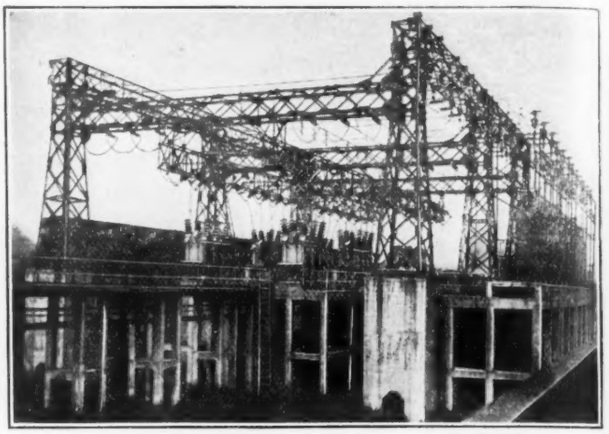


FIG. 5—ONE OF THE HIGH-TENSION YARDS WITH APPARATUS ELEVATED TO ESCAPE HIGH WATER

In the 66-kv. yard of the American Gas & Electric Company a double 66-kv. bus has been provided. It is at present supplied by a bank of 20,000-kva. transformers, as all outgoing 66-kv. feeders are connected to this bus. Provision is made for future installation of a bank of 66-kv. transformers when the load conditions require it. In the West Penn high-tension yard the 66-kv. bus is normally only a transfer bus, the energy being supplied through a bank of 30,000-kva. transformers. The same provision for flexible operation is made in this yard as obtains on the 130-kva. bus of the American Gas & Electric Company.

The control of turbines, exciters and auxiliary trans-

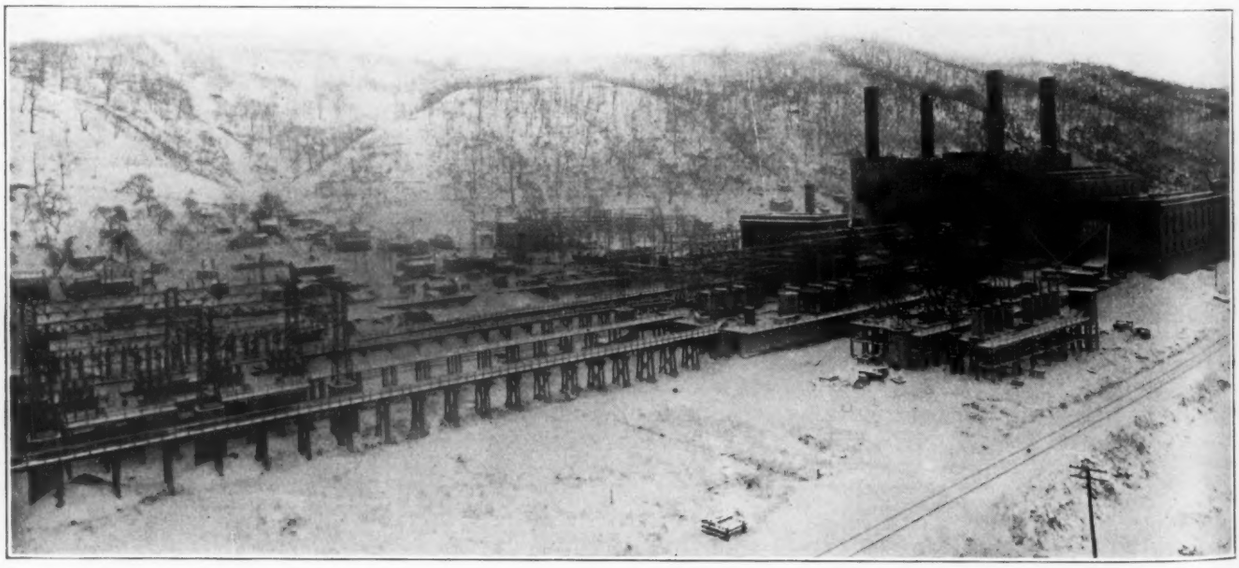


FIG. 4—HIGH-TENSION YARDS OF WINDSOR (W. VA.) POWER PLANT CONNECTED WITH STATION BY BUSBARS CARRIED IN TUNNELS

formers is centered on a benchboard so placed in the operating room that the operator faces the turbine room while handling the equipment. A glass partition between the operating room and the turbine room permits a view of practically the entire floor of the latter. Outgoing feeders are controlled from a vertical switchboard

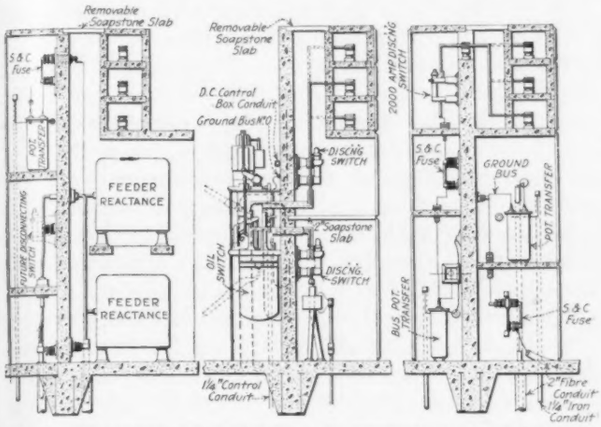


FIG. 6—FEATURES OF REACTOR, OIL-SWITCH AND POTENTIAL-TRANSFORMER SECTIONS OF CONCRETE COMPARTMENTS

at the opposite side of the room from the benchboard. Voltage regulators and curve-drawing instruments are installed on pedestals at the center of the room. The 600-volt direct-current board and the watt-hour-meter board are at opposite ends of the operating room. This arrangement places the switchboards requiring the most attention at the most convenient location for the operator. It was also thought advisable to place the battery-charging equipment and panels in an alcove off the operating room where they are readily accessible to the switchboard operators. One of the unusual features in this room is a provision for reading the temperatures of transformers in the high-tension yard and the temperatures of important parts of the 30,000-kw. generators. Alarm bells and lamps are also placed here to warn operators of any interruption in the flow of cooling water to the high-tension transformers.

The 11-kv., 25-kv., 66-kv. and 130-kv. feeders are all equipped with induction-type inverse-time-limit relays, while the transformers are protected by definite time-limit relays. The 25-kv. and 66-kv. relays are given a minimum setting of two seconds, the 130-kv. relays three seconds, and the transformer relays also three seconds. The settings for the 11-kv. feeders, which will supply only local territory, are not determined.

The turbo-generators, oil switches, switchboard equipment, auxiliary transformers, reactors, auxiliary motors and turbines and equipment in the high-tension yard of the American Gas & Electric Company were supplied by the General Electric Company. The condensers, stokers and all equipment in the West Penn high-tension yard were supplied by the Westinghouse Electric & Manufacturing Company. The boiler-feed and service pump were supplied by the Worthington Pump & Machinery Corporation; the bilge pumps by Yeoman Brothers Company with Cutler-Hammer control, and the traveling screens by the Chain Belt Company. The oiling system was supplied by the Richardson-Phenix Company, while the soot cleaners were supplied by the Diamond Power Specialty Company and the cranes by the Whiting Foundry & Equipment Company. The design and construction of the station, including the high-tension yard of the West Penn Power Company, were carried out by Sargent & Lundy, consulting engineers, Chicago. The high-tension yard of the American Gas & Electric Company was handled by the Electric Bond & Share Company. The sub-contract for the building foundations, the high-tension yard foundations and the railroad foundations were all awarded to the Foundation Company of America. The Riverside Bridge Company obtained the contract for the steel.

OUTPUT COEFFICIENTS FOR D.-C. MOTORS OF SMALL SIZE

Convenient Method of Arriving at Trial Values of Armature Diameter and Length Before Actually Designing the Winding

BY E. W. KELLOGG

THE accompanying curves were intended to supplement courses in dynamo design, but they may be of interest to motor designers in general, inasmuch as they illustrate a very convenient method of arriving at trial values of armature diameter and length. Some textbooks give curves showing average values for flux density as dependent upon armature diameter, and of ampere conductors per inch of circumference in terms of kilowatts rating. Inasmuch as a considerable error in the first assumed value of armature diameter makes only a slight difference in the permissible flux density, the curves mentioned furnish the necessary information for finding the value of D^2L for the armature.

In another curve the total ampere conductors are plotted against watts ÷ r.p.m. This information, in conjunction with the value of ampere conductors per inch already found, determines the armature circumference and hence the diameter. The diameter so found is to be considered as a trial value only, the general procedure* being to try several values above and below

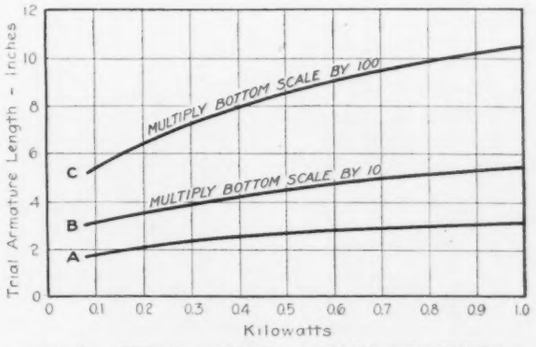


FIG. 1—AVERAGE VALUES OF ARMATURE LENGTH

this, carrying the trial designs to a point where one is seen to be definitely better than the others.

METHOD OF DETERMINING TRIAL PROPORTIONS

The plan of varying the proportions and carrying along several trial designs seems to the writer by far the most instructive way of handling the problem. The plan of first determining a value of D^2L and then trying different combinations of D and L presupposes that the flux density and the ampere conductors per inch of circumference will not be materially affected by

*Gray's "Electrical Machine Design."

the changes in diameter. This is true of large and medium-sized machines, but with armatures less than about 10 in. (25.4 cm.) in diameter the output coefficient falls off rapidly with decrease in diameter, so that an armature 4 in. (10.16 cm.) in diameter and 5 in. (12.70 cm.) long would in general show less capacity

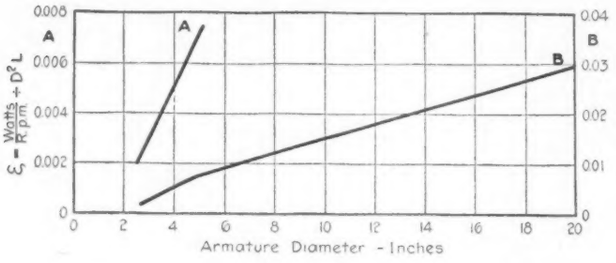


FIG. 2—AVERAGE VALUES OF OUTPUT COEFFICIENT FOR NUMEROUS MACHINES OF DIFFERENT MAKES, SPEEDS AND SIZES

at the same speed than an armature 5 in. in diameter and 3.2 in. (8.1 cm.) long, although the product D^2L is the same for the two. The reason for this lies principally in the fact that with small diameters the slots cannot be made so deep, the space factor is likely to be lower, and the teeth have a greater taper, which makes it generally necessary to use lower flux densities. On the other hand, within reasonable limits the capacity of the machine is directly proportional to the armature length.

A more satisfactory method of procedure for small machines is to select a trial diameter and determine the watts output per inch of length at the speed which has been selected and thus find the necessary armature length. Another diameter may then be tried, the corresponding length determined in the same way, and the designs compared. Instead of finding the volts per

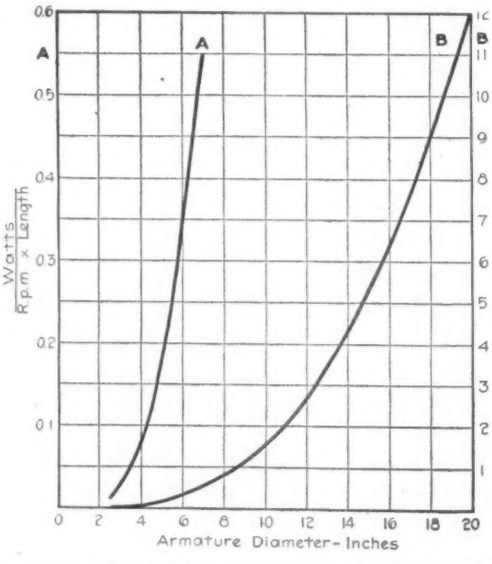


FIG. 3—OUTPUT (WATTS) PER R.P.M. PER INCH OF ARMATURE LENGTH

conductor first and then finding place on the armature for the necessary number of conductors, the type of winding, number of slots, size of wire, number of conductors per slot and their arrangement and insulation should be determined and the dimensions of the teeth and flux density worked out. The output per inch of length can then be calculated and the armature length fixed.

A 2-hp., 110-volt, 1800-r.p.m. motor will be used to illustrate. Six inches (15.2 cm.) will be selected as a trial diameter, and a two-hole winding, consisting of thirty-five coils of six turns each, of No. 12 B. & S. gage wire will be tried. This requires thirty-five slots, 0.25 in. (0.63 cm.) wide by 0.8 in. (2.03 cm.) deep, which gives a tooth width of 0.15 in. (0.38 cm.) at the root. An apparent flux density of 160,000 lines per square inch (24,800 lines per sq. cm.) at the tooth root corresponds to a gap density of 43,000, which with a pole inclosure of 0.65 gives 0.158 volt per inch (0.062 volt per cm.) of conductor. There are 210 conductors in series in each path, so that the necessary voltage per conductor is 110 ÷ 210 = 0.523. The armature length must then be 0.523 ÷ 0.158 = 3.3 in. (8.4 cm.).

Some guide is desirable in order that the diameters chosen for trial may not depart too far from normal. Average values of armature length expressed in terms of kilowatts rating appear to be as satisfactory a guide as can be found. For a given rating the best armature length is nearly the same for a high-speed machine as for a low-speed machine, the difference in speed being compensated for chiefly by a change in diameter, with only a slight change in length. Fig. 1 shows average values of armature length.

CURVE GIVING APPROXIMATE DIAMETER

Since with small machines the value of D^2L can hardly be calculated until the diameter is known, additional curves are needed from which the probable diameter can be found in terms of the power, speed and armature length. Such curves are given in Fig. 3. To use them the output in watts is divided by the speed in r.p.m. and by the approximate length as given by Fig. 1. This gives the ordinate of Fig. 3, from which the diameter can be obtained.

For example, in the 2-hp., 1800-r.p.m. motor mentioned before, taking the iron, windage and friction losses at 10 per cent, the power converted would be 1660 watts, and watts ÷ r.p.m. = 0.92. The armature length from Fig. 1 would be about 3.4 in. (8.64 cm.). The ordinate to the curve in Fig. 3 would be 0.92 ÷ 3.4 = 0.27, which corresponds to a diameter of 5.6 in. (14.2 cm.).

The normal diameter and length found in this way are only intended to give an idea of what would be reasonable size and proportions. The next step would be to select several trial diameters and determine the length corresponding to each by designing the winding and determining the flux density, and to work out the several designs to the point where one appears clearly the best. The output coefficients may come out lower than those indicated in Fig. 2 if the slot space cannot be well utilized, or much higher output coefficients may be obtained, especially if greater losses are allowed.

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Reducing Costs of Fuel and Boiler Maintenance

How These Costs Can Be Reduced by Softening Boiler-Feed Water—Experiences of Different Users—Features of Different Systems and Operating and Investment Expenses

BY S. B. APPLEBAUM
Assistant Technical Manager the Permutit Company

WITH the increasing scarcity of coal due to increased consumption and congestion of transportation and with the generally higher cost of fuel it is the duty of every one to investigate every possible way that fuel is wasted and how the wastage may be prevented. There is no doubt that the general consideration of burning the coal efficiently in the boiler furnace comes first, but the heating surfaces of the boiler must also be kept clean, otherwise the heat produced in the furnace cannot be utilized fully. Every engineer and fireman knows these things, but they have not been watched carefully in the past owing to the great wealth of natural resources. The time has come, however, when ways must be changed and every pound of coal made to count.

Unfortunately, scale cannot be blown off the tubes like soot, it being necessary in a great many cases to chisel or turbine out the deposit. The question is how much fuel scale really wastes and whether the waste is sufficient to warrant the investment in a water-softening plant to prevent the formation of scale.

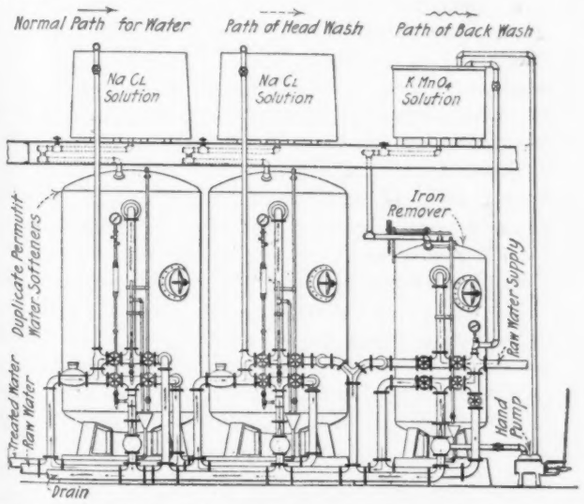


FIG. 1—ARRANGEMENT OF WATER SOFTENING AND PURIFYING TANKS USED BY ONE CENTRAL STATION

PREVIOUS PUBLISHED DATA ON SAVINGS

Published experimental data on this subject are not in great abundance. Between 1898 and 1908 the engineering experiment station of the University of Illinois ran a series of tests on a locomotive and on individual boiler tubes in order to throw some light on the subject, publishing the results in its *Bulletin* 11 (1908). The locomotive, taken from the Illinois Central Railroad, was run with about 3/64 in. (1.19 mm.) scale in it for about twenty-one months. Then the engine was cleaned and run for two days clean. The loss, based on equivalent water per pound coal evaporated from and at 212 deg. Fahr., amounted to 9.6 per cent. The individual boiler-tube tests with scale up to ⅛ in. (3.175 mm.) thick showed widely varying losses up to 12 per cent, depending on the mechanical structure of the scale and the thickness.

An article by H. G. D. Nutting, published in the ELECTRICAL WORLD (Volume 66, No. 23, page 1257), described a water-softener installed in a central station in Wisconsin. The effect of the treatment was as follows: "The coal bill has been reduced 18 per cent of its former amount, based on the same load. The coal bill for July, the second month of use of the water softener, was $514 less than for May, when the softener was not in use—*i.e.*, based on the same output."

RAILROAD EXPERIENCE

Railroads are the largest users of fuel in boilers for the generation of steam, and their experience is most valuable to illustrate the various operating losses due to scale. In 1905 the American Railway Engineering and Maintenance of Way Association, which has a standing committee on water service, issued a report* on "Comparison of the Cost of Installing and Operating Water-Softening Plants, with the Benefits Derived from Their Use." From the experience of about forty railroads with water-treatment plants it selected several as furnishing the most authentic records, each of them having installed at least fifteen or more water-softening plants up to that time.

A summary of the data given in this report follows:

The Atchison, Topeka & Santa Fé Railway installed water softeners in 1903 on divisions in Kansas and Colorado. In December, 1902, it had 456 locomotive-boiler failures from leaking. By using softened water failures from this cause were reduced to only sixty-eight in December, 1903, and twenty-eight in July, 1904. The average annual reduction in such failures due to water softening was 74 per cent.

As regards saving of flues, the locomotives made 363,302 miles (about 584,500 km.) more in the year ended July, 1904, than in the year previous and the store department issued 109,937 linear feet (about 33,500 m.) of flues less than the year before, which was a saving of about 20 per cent in flues. The saving in the labor of boilermakers for repairs for the same time was $7,000.

The Chicago & Northwestern installed seventeen water softeners in 1903 on its Iowa Division, and these took care of all the natural hard-water stations in the division. The saving in the cost of labor for boilermakers was 36 per cent. The number of failures due to leaks was 583 from August, 1902, to June, 1903. The corresponding number from August, 1903, to June, 1904, was only 120, representing a reduction in failures of 79 per cent. There was also a heavier ton-mileage in 1903 than in 1902, the increase being 7 per cent. The coal saving was 4.2 per cent, since in 1902 the tonnage was handled by 28.7 lb. (13 kg.) of coal per 100 ton-miles and in 1903 by 27.5 lb. (12.47 kg.) of coal per 100 ton-miles.

Furthermore 7 per cent more tonnage was handled by fewer engines, the saving being five engines out of 159, or 3.1 per cent. This item is of extreme interest during these

*Volume 6, 1905, pages 597-611.

days of scarcity in the supply of trains and locomotives.

Besides the above, there are a number of benefits difficult to evaluate but extremely important as having a bearing on power-plant practice. For instance, there was a saving in time for engines to make their trips, due to fewer failures and therefore less expense for overtime labor and fewer delays for repairs on the road.

The results of eight years' use of softened water on the Southern Pacific Railroad system show a saving of 50 per cent in the expense of boiler repairs.

The average monthly locomotive mileage on the Union Pacific system has increased 27 per cent since the installation of the water-softening plants. Freight-train statistics also show "an increase in ton-miles per pound of coal of 7½ per cent and a decrease in cost of repairs per locomotive mile of 34 per cent." The saving in repairs can be seen from the increased life of flues. "The average life of a set of flues in passenger locomotives with hard water was six months; since softening the water the average life is two and one-half years."

The committee's report in conclusion attempts to describe the general water conditions under which water softeners would produce savings by stating that "it would be a benefit to soften water used in locomotive boilers that contains 15 or more grains per gallon of hardening matter, or even less than 15 grains, if the hardening matter consists largely of sulphate of lime."

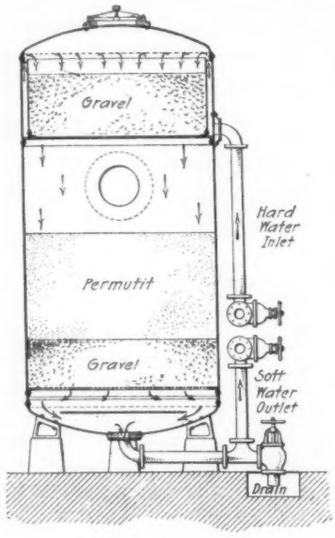


FIG. 2 — EXCHANGE-SILICATE TYPE OF WATER SOFTENER

There are several cases in the writer's own experience, however, which illustrate the possibility of severe operating losses with a water having a hardness far below the committee's limit of 15 grains. A few weeks ago the chief operating engineer of one of our largest chemical manufacturing companies described to the writer conditions in one of its mills using the Delaware River water, having a hardness of between 3 and 4 grains per gallon in its eight 500-hp. horizontal water-tube boilers. The engineer of the plant showed tube charts which gave the average life of the tubes as six to eight weeks. The boilers were in constant danger of shut-down owing to tubes suddenly failing, and in several instances there was serious loss of life. The condition was due entirely to scale, which seemed to collect in sufficient quantity in tubes to prevent circulation and so cause overheating, blistering and bagging of the tubes. This same condition is probably familiar to other users of boiler-feed waters just as soft as the Delaware River wherever the boilers are operated at high overloads continuously. A boiler operating at 200 per cent rating with a 4-grain water has just as much scale deposited in it in the same period of time as a similar boiler operating at 100 per cent rating on an 8-grain water.

BENEFITS REALIZED BY OTHER CENTRAL STATIONS

That the installation of a water softener is warranted even with very soft natural waters is borne out by two other instances: A central station in Brooklyn, N. Y., installed a water-softening plant to obtain water of zero hardness three years ago on the city supply of only 2 to 3 grains per gallon of hardness. The boilers (about forty of various types) develop a total of about 25,000 hp. and are run at high overloads during the peak periods. The use of the zero water has kept the boilers in such condition that these extreme peak ratings can be maintained with reliability and security at all times.

By installing the water softener this central power plant undoubtedly saved an investment for additional spare boilers which would be necessary to take up the load quickly in case of failure of some of the units in operation and actually saved about 50 per cent of the original investment in the cost of boiler repairs and the large amounts of soda ash formerly used directly in the boilers.

In a large textile plant at Bridgeport, Pa., using the Schuylkill River for its water supply (hardness, about 6 to 8 grains per gallon) the results of the first four months' run on "zero water," as compared with the same months of the previous year, showed a monthly saving in coal of 100 tons to 200 tons, compared with a consumption on hard water of 600 tons to 800 tons. The boiler plant consists of ten 150-hp. horizontal return-tubular boilers, the total horsepower developed being 1700. The same months in both years were chosen because the load was approximately the same during both periods.

It is interesting to note that the saving increased steadily during the four months in question because the scale was not completely removed when the water softener was started in operation. During the first month the saving was 102 tons, second month 166 tons, third month 208 tons, fourth month 216 tons. The soft water removed the old scale gradually, and the decreasing amount of scale present caused a corresponding decrease in coal used.

The old standards and ideals adopted for the quality of feed water are changing. The practice of maltreating boilers by using any water in them, then "doping" the boilers with some compound or soda ash and periodically cleaning the boilers with chisel and hammer, is a thing of the past. With boilers costing to-day $35 to $40 per horsepower to install they are worthy of the fine care and attention constantly given to engines. With the present practice of running boilers, especially in central stations, at 200 per cent to 300 per cent rating, and with the necessity for absolute reliability and certainty, the need for the best water with the least possible scaling contents is rapidly becoming realized.

The station operating committee of the N. E. L. A., in describing the results obtained from a water softener in a large central steam company's plant in Manhattan operating on New York City supply of 2 to 3 grains per gallon, has this to say:

> The results obtained develop a fact that is of great interest—that scale will form where boilers are operated at such high rating—200 per cent—if the water contains a hardness such as is usually obtained in the average water-softening plant. That is, boilers will not be free from scale if fed with a water of 4 grains hardness; therefore a greater refinement must be obtained to meet this condition. The demand for 200 per cent of rating is growing as more and more plants are being built to operate at that rating, and greater care will have to be taken to put into such boilers water containing the least possible hardness.

FEATURES OF VARIOUS SYSTEMS OF WATER SOFTENING

Lime-Soda Type.—In general there are two broad types of water softeners to consider. One is the lime-soda type, the other is the exchange-silicate type. The former consists of adding to the water lime and soda ash in fixed amounts depending on the chemical analysis of the raw water, allowing the dosed water, thoroughly mixed with the chemicals, to settle in large tanks, and then clarifying the settled water. This may be done with the water in a cold condition or by using a heater in advance so that the chemical reactions take place with hot water. The heater softeners permit of a smaller settling tank than the cold treatment, and the softened water if properly treated may have about 3 grains per gallon of hardness instead of the cold softened water of about 5 grains. But unless there is sufficient exhaust steam available to produce a temperature of over 200 deg. Fahr., there is no economy in the heater softener over the cold type because of the rapid radiation of heat from the large exposed area of the surface of the hot settling tank and separate hot filter. Furthermore, the washing of the filter and blowing off of sludge from the hot settling tank causes considerable loss of heat in the hot water wasted down the sewer.

The cold type of lime-soda softener may either be intermittent or continuous. The former consists of two or more settling tanks and filters with one tank being filled, dosed with the correct charge of chemicals, and then agitated in order to mix thoroughly while the other tank or tanks are settling and being used. The advantage of this type is that with waters of variable chemical composition the charge of chemicals may be suited to each tankful correctly. But the intermittent type naturally takes up a relatively large space and the foundations are expensive.

The continuous type feeds the chemical continuously into the water, which enters the settling tank at a constant rate, settling and then filtering, the water passing from chemical feed to filter without stopping. This type is as responsive as the intermittent with the average water supply where the chemical composition changes gradually, so that by analyzing the raw and treated water once a day the correct charges may be prepared for the day.

With all types of lime-soda water softeners the important things to watch are the size of the settling tank, the size and type of the filter and the allowable causticity in the treated water. In competition the size of the main parts naturally determines the cost, and unless these sizes are specified, competitive bids cannot be compared. It is just as necessary to check up a manufacturer's specification of a water softener as, for example those of a pump. With lime-soda softeners it is absolutely necessary to have a sufficient reaction and settling time to permit the chemical reaction to take place. If the settling period[1] is cut down, these chemical reactions take place after the water leaves the water softener, and clog up heaters, piping and boilers with the resulting precipitates.

Secondly, the filter should be of quartz and not of excelsior or some other medium. Sand grains catch the precipitate best and can be easily washed by reversing the flow. The filters should be designed large enough to permit a low rate of filtration,[2] otherwise the precipitates may slip through.

As regards the allowable hydroxide causticity in the softened water, a limit should be set for this of about 2 grains per gallon, expressed as $CaCO_3$. If no limit is set, it means that the water may be overdosed to get the guaranteed hardness. This overdosing is expensive with soda ash at 3 to 4 cents per pound, and a high causticity leads to other difficulties in boiler operation.

Exchange-Silicate Process.—The exchange-silicate process of water softening is a radical departure from the lime-soda type. The water is passed through a bed of granular insoluble sodium-aluminate-silicate, and all of the calcium and magnesium are exchanged for sodium. The exchange silicate takes the calcium and magnesium and in exchange gives its sodium to the water. The reactions are direct exchanges just as take place with soda ash in the lime-soda water softener. But the exchange silicate, being insoluble, is present in such high excess that all of the hardness is removed and a water of zero hardness results.

As explained previously, the addition of lime and soda ash reduces the hardness to 3 to 5 grains, and a causticity in the treated water results from the excess of soluble chemicals which was added to drive the reactions to those limits. Perhaps if the excess used and the resulting causticity were allowed to go high enough the hardness of the treated water might go lower. But with the exchange-silicate method the high excess is used and yet no causticity results because the silicate is insoluble. That explains why "zero" hardness water is possible by this method. The softening filters containing the exchange silicate are equipped with water meters, and when the designed capacity of a filter has been reached it is shut off and a solution of common salt or brine is introduced for about eight hours. This is called the "regeneration" period, and the salt solution restores the sodium to the exchange silicates, driving out the calcium and magnesium absorbed by the filter bed during the previous day's run. This salt is washed out and run to the drain in the morning, and the softening filter is then ready for another day's run. For continuous twenty-four hours' service two units are used in alternate service.

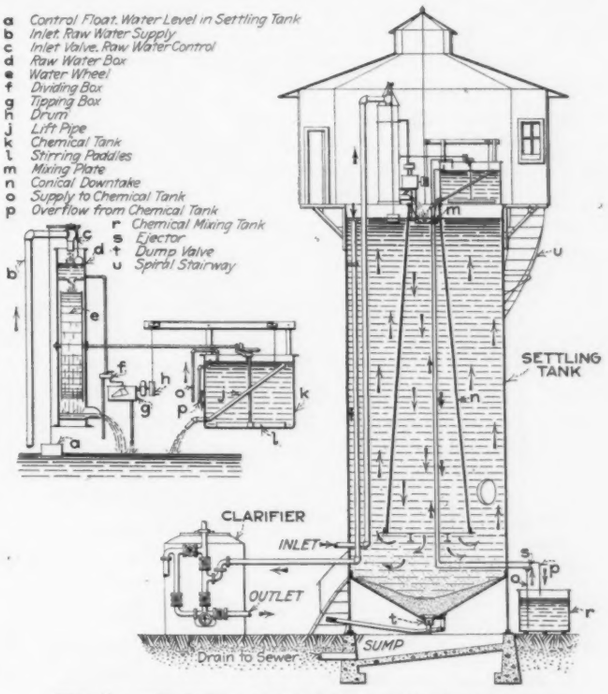


FIG. 3—ONE TYPE OF LIME-SODA WATER SOFTENER

There are some waters, however, which can most economically be softened by a combination of the lime pre-treatment followed by the exchange-silicate filtration. This combination treatment has been strongly developed in England. In the United States also there are quite a few combination lime-exchange-silicate plants, especially in the Middle West. The advantage of the combination process over the single methods is found in large water-softening plants with waters containing a high temporary hardness of calcium and magnesium bicarbonates. The lime actually removes the temporary hardness down to several grains per gallon and so reduces the total dissolved solids in the water.

With waters of high permanent hardness, however, there is no advantage in the combination process because soda ash works by exchange on the permanent hardness just as the exchange silicates do. Furthermore about 3 lb. to 4 lb. (1.36 kg. to 1.82 kg.) of salt is needed for regeneration as against 1 lb. (0.45 kg.) of soda ash. With salt at 1/3 cent a pound and soda ash at 3 cents per pound the comparative cost of removing permanent hardness by the two processes would be 1 1/3 cents for the exchange silicate and 3 cents for the soda ash.

[1] The city of Columbus allows eighteen hours' settling in the municipal water-softener.

[2] In the city of Columbus a rate of 2 gal. per square foot per minute is allowed.

INVESTMENT AND OPERATING COSTS

The comparative investments in different water-softening systems depend entirely on the composition of the water. Lime-soda plants remain fairly constant in cost with varying compositions, whereas exchange-silicate plants increase in size and cost with increase of hardness in the raw water. Cost of treatment depends also on the water composition and the proportion of temporary and permanent hardness. The cost of lime treatment alone is about one-third to one-half the cost of the corresponding salt for regeneration, but, as pointed out in the foregoing, the cost of the soda-ash treatment is about three times the cost of salt for regeneration. In conclusion, a typical case will be analyzed to determine the actual savings that would result from installing a water softener without reference to the type used. Take a water of the following composition (same as water in the Bridgeport installation mentioned above):

		Grains per Gal.
Total hardness,	as $CaCO_3$ = 130 p.p.m.	= 7.7
Calcium hardness,	as $CaCO_3$ = 80 p.p.m.	= 4.7
Magnesium hardness,	as $CaCO_3$ = 50 p.p.m.	= 3.0
Alkalinity,	as $CaCO_3$ = 80 p.p.m.	= 4.7
Temporary hardness,	as $CaCO_3$ = 80 p.p.m.	= 4.7
Permanent hardness,	as $CaCO_3$ = 50 p.p.m.	= 3.0

Assuming a boiler plant of 3000 hp., consisting of ten boilers with no returns using 12,000 gal. (45,400 l.) per hour raw feed water, the first cost including foundations and connections would be about $20,000. The cost of operation for chemicals would be about 3 cents per 1000 gal. (3785 l.). With a coal consumption of 1 lb. (0.45 kg.) per 8 lb. (3.62 kg.) of water evaporated, the average daily consumption of coal would be about 150 tons. Assuming a price for coal at $4 per ton and a saving of 5 per cent for fuel, then the fixed and operating charges of water softener would be

	Per Year
288,000 gal. per day × 3 cents = $8.64	= $3,150
Labor of operation	= 500
Interest and depreciation, at 10 per cent	= 2,000
Total	$5,650
SAVINGS:	
Coal.—150 tons × 5 per cent = 7½ tons per day = 2740 tons per year, at $4	= $10,960
Cleaning boilers.—Assuming that the boilers were formerly cleaned six times per year and are now only inspected, six cleanings saved, at $30 per boiler, 6 × $30 × $10 =	1,800
Tube saving and repairs	= 1,000
Total	$13,760
Deduct	5,650
Net saving	$8,110

Therefore the return on investment = $8,110/20,000 = 41 per cent, or the plant would be paid for in two and one-half years out of the savings.

If the plant were operating condensing at considerably above normal rating, as is usually the case in central stations, the net saving would be much greater and the softener would pay for itself more quickly, probably inside a year. This statement is based on the assumption that the percentage saving in fuel is the same in both cases and does not take into consideration the value of having more reliable service, the avoidance of damage from bursting tubes, the expense of shutdowns, or the investment otherwise required in reserve boilers. Each case should be studied individually and the water analyzed by a chemist.

TELEGRAPHS AND TELEPHONES IN THE FIRST YEAR OF WAR

Extensive Communication Facilities of the Country Are Fully Organized for War Service to the Nation

BY JOHN V. L. HOGAN

Vice-President Institute of Radio Engineers, Commercial Manager International Signal Company

SINCE the United States went to war the communication systems have been concerned mainly with establishing and maintaining their business and personnel upon a war basis. Naturally enough, the wire telephone and telegraph systems and the cables, as well as radio-telegraphy, have been strongly affected. Probably the greatest changes have occurred in the radio or wireless field, because of the peculiar utility of that mode of signaling for various military purposes.

WIRE AND CABLE LINES ACTIVE

On the whole, the wire and cable lines are carrying on "business as usual," except for the difficulties introduced by the loss of the trained civilian staff to the signal services of the army and navy and by the necessity of giving precedence to the immensely increased government traffic, which has grown in volume so rapidly. The telegraph companies have found it desirable to re-employ retired operators who had given up work at the Morse key. Many additional women employees have been placed in operating, clerical and supervisory posts formerly occupied by men. It seems likely that the desire to hold down plant expenses during unsettled times will be overbalanced by the scarcity of skilled operators, and that, consequently, the use of automatic and printing telegraphs will increase. Up to the present the installation of these modern and effective traffic channels has been limited to intercity lines over which abundant message business could always be had, since their expense seemed justified only in these instances. Looking ahead, however, the indications are that the quantity of available traffic will cease to be the only determining factor.

Increased use of the printing telegraph is also favored by the recent independent developments of devices in which much of the complication and expense of the older systems is avoided. The day is at hand, if not actually here, when keyboard transmitters and automatic typewriting receivers may be plugged in at the terminals of any normal simplex or duplex line and thereafter operated by untrained clerks at a message speed greater than that attained by the best hand Morse operators. The invention and perfection of machines whose operation is substantially independent of line conditions makes it feasible for a main office to use three or four sets of automatic apparatus for a dozen or more trunks, clearing congested traffic as necessity arises.

The telegraph systems of the country have become more heavily loaded in at least two ways—(1) because of the growing need for quick communication which results from the large amount of war-time production, and (2) on account of the daily increasing delays in the mails, which, of course, enforce larger use of telegraphic messages. On the other hand, telegraphic traffic is cut down by the natural stimulus to economy which accompanies uncertain financial conditions and also by the increased urgency which in many instances

necessitates telephonic communication, even at increased cost. Just how these several factors will finally affect the general traffic load cannot be determined until detailed message reports are available, but it seems likely that a marked growth in telegraph business, and especially that of the "night letter" classification, will be found.

Uncertainty in transatlantic mails, the essential close co-operation between our government and those of our European allies and the diversion of long-distance wireless stations for military uses have all tended to increase cable traffic. More stringent censorship regulations, which add to the burden of the cable staff, have come as a natural result of the state of war. However, nothing abnormal has been reported in the way of interruptions (perhaps because of the scarcity of enemy raiders left at large), and, in its entirety, the cable business seems to have been little changed. Certain technical advances, including the practical use of selenium and other relays, have been continued throughout the year, but no particularly sensational improvements have been announced.

Heavy Demands on the Telephone Service

Commercial long-distance telephony has suffered since the beginning of the war. In spite of careful plans for keeping essential members of the plant and operating organizations at their normal posts, on account of their value to the government communications in their usual daily work of providing good intercity telephone services, it is reported that so many have entered the Signal Corps and naval communication department that the telephone companies are actually handicapped. Moreover, a large number of long-distance trunk lines have been turned over directly to the government and are used entirely for official conversations. These are lost to the commercial service, since they have not been completely replaced by new lines in proportion to an increasing volume of long-distance traffic. Thus the usual business message service is not only somewhat poorer than in the past, but it also appears to be subject to more frequent and longer delays in times of storm. In consideration of the tremendous work the telephone organization is doing directly for the army and navy, however, the "non-essential" (from the war work viewpoint which must prevail to-day) uses of the telephone are in fact limited only very slightly.

The tremendous expansion of local government telephone service in large cities, and particularly in Washington, has crippled normal work to a considerable extent. New telephone instruments have been called for in such large quantities that companies have been forced to refuse to extend many private installations. Increased demands upon central offices and the larger private branch exchanges, as well as the withdrawal into military service of many men switchboard operators, have brought a large number of inexperienced girls into the work, and this naturally increases confusion and delay despite the best efforts of the companies. Without a doubt readjustments of plant and employees will relieve current difficulties where they are now most evident, and the telephone companies deserve full credit for the way in which they have continued to perform their important duties.

An interesting and relevant topic in connection with telephony is the extension of women's work into the positions formerly held almost exclusively by men. Telephone companies have always had large numbers of women employees; but in common with many other industries they have not been fully cognizant of the availability of women for positions requiring long and technical training. It is most significant, though not generally known, that the complicated mathematical operations involved in transmission and other problems considered by the telephone engineering departments are worked out largely by women who specialized in mathematics at college and were employed thereafter as computers.

Great Changes in Wireless Field

War conditions have brought great changes in the wireless-telegraph field. In the first place, all commercial shore stations were closed by order of the President immediately after the United States entered the war. This put a stop to actual and anticipated international and overland radio traffic. Wireless outfits were permitted to remain in operation on shipboard as a matter of safety to passengers and cargoes, but communication has been limited strictly to necessary position reports, warnings and similar maritime matters, all of which are sent in cipher. The Navy Department maintains a chain of land wireless stations along the shores of the country and has extended its service to comprehend essential commercial radio traffic, but since this must be entirely subordinated to governmental affairs the total number of private messages is extremely small.

In taking over and building many cargo ships the government has also acquired the ownership, control and operation of the radio apparatus upon them. Some hundreds of vessels using a large Eastern port are now entirely in the hands of the naval radio service as regards the inspection and maintenance of their radio apparatus and the supply of operators for them. The various wireless companies have largely become manufacturers for the army and navy, since their operating and research branches cannot continue on anything approaching the pre-war basis. Development of new inventions is directed almost entirely toward their utility in war work, and only those which are of the greatest actual or potential value to the military and naval services can justly be given full attention.

Gratifying Absence of Waste

In view of their immense value and importance it is only natural that the communication facilities of the country should be so fully organized for war service, but it is especially gratifying to see that the radical changes in policy and operating methods throughout the several systems for transmission of intelligence have caused so little waste. So far as can be seen, the cable and wire channels will grow to be of even more utility to the government without seriously reducing their commercial value. The commercial future of radio, however, seems to be dependent largely upon its general technical development, and consequently the present period of military domination must be looked upon as a necessary setback resulting from the availability of wireless communication as a weapon. When the great war is won and conditions are more normal again, the useful future of radio signaling will come into sight once more, and this newest of the communication arts should progress rapidly to its fuller development.

Application of Motors to the Textile Industry

Increased Production Possible with Motor Drive Tends to Reduce Mill Investment per Unit of Output—Factors Affecting Selection of Motors and Control Apparatus

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

A brief statement of the power situation in the textile industry in reference to the increasing use of motors for this class of machinery. Types of motors now commonly employed are described, with notes on the control auxiliaries in standard practice; the economic advantages of the adoption of motors in preference to steam or water power are dwelt upon, and the principles outlined in the article are illustrated by reference to actual installations where examples of both belted and directly coupled motors are found.

THREE factors stand out prominently in the cotton textile industry that have an important bearing on the application of motors in this field: First, the enormous increase in the value of the products during the last fifty years; second, the large capital invested,[1] which makes a high rate of production essential to the economical operation of such plants, and, third, a decreasing proportion of water power used in terms of the total power together with an unusual increase in the use of electric power.

In the earlier days of the cotton-textile industry water power was the largest source for driving purposes, forming about 60 per cent of the total in 1870, with steam power about 40 per cent. In 1910 water power dropped to about 20 per cent of the total, steam power increased to about 60 per cent, and the remainder was largely electric power. Beginning about 1900, therefore, and with a rapidly increasing growth, electric power has been applied to textile machinery, this growth being so marked that Rickards[2] has estimated roughly 40 per cent as the probable proportion of electric power to be used in this industry two years hence.

FIG. 1—EXAMPLE OF DIRECT-CONNECTED MOTOR DRIVE IN A SPINNING ROOM

To show the place held by the motor in the textile industry, the limitations experienced with the operation of these plants by mechanical means from steam and water power will be cited. Utilization of water power, which was a general method in the earlier plants, usually made it necessary to locate mills at points inconvenient for shipping and resulted in a less flexible arrangement than when other motive powers were employed. If the wheels are at one end of the mill, the long-line shafting thus required introduces high friction losses and other mechanical difficulties.[3]

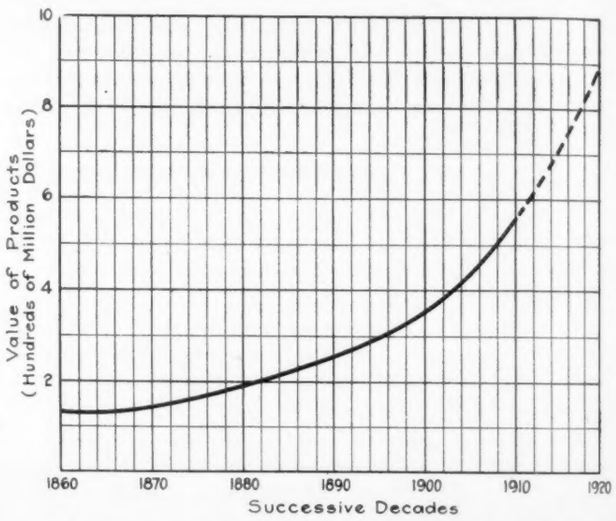


FIG. 2—INCREASE IN VALUE OF COTTON TEXTILE PRODUCTS

The more flexible arrangements possible with a steam plant, its adaptability to central locations by which shafting may be extended on either side of a central tower, and the ability it gives to locate the plant at a point convenient for shipping make it a more favorable source of supply than water power. These advantages, together with the improvements of steam engines in recent years, have resulted in a considerable increase in the use of steam power, with a corresponding decrease in the growth of water-power plants.

Both of these sources, however, require mechanical transmission, and the exacting requirements of certain machinery, like looms, which must be stopped and started up under full load continuously, impose severe stresses on the belts connected with such drives. Added to this are the effects of speed regulation and presence of dirt, which may fly off from the belts, etc., on the quality of the product. In these directions motor drive has proved its superiority over the other power sources.

The motor has thus gained much headway in this

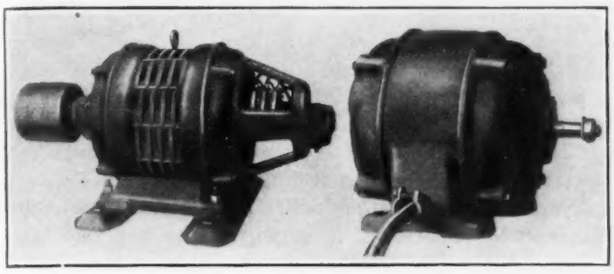
[1] In recent years the amount of capital required per unit of output value has decreased, indicating that manufacturing efficiencies have increased.

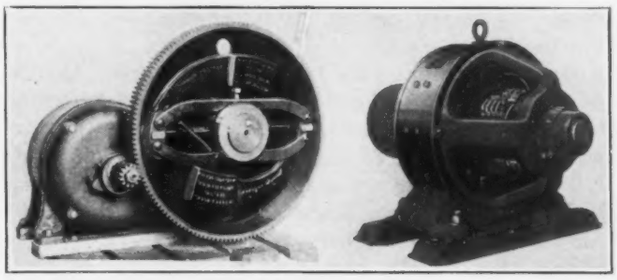
[2] See *Electric Journal*, Vol. XI, No. 7, p. 404. Fig. 2 has been drawn from information in this article, and other references are made to it in this discussion.

[3] The reader is referred to a treatment of power in textile mills by William W. Crosby, "Standard Handbook for Electrical Engineers," fourth edition, p. 1267, to which several references have been made in the preparation of this article.

field as an aid to accuracy and uniformity in the manufacture of a more or less delicate product. The reduction or entire avoidance of speed fluctuations is a factor entering into both the quality and the quantity of the output. As usual in electrical developments of this kind, much effort has been expended by the motor and

Squirrel-cage induction motors are well adapted to the conditions because of their simplicity of structure and the absence of a commutator. Motors of this type, as used for textile work, are designed for operation at reasonably low temperatures and uniform speed and possess high efficiency, high power factor and low slip.





FIGS. 3 AND 4—SEVERAL TYPES OF TEXTILE-MILL MOTORS

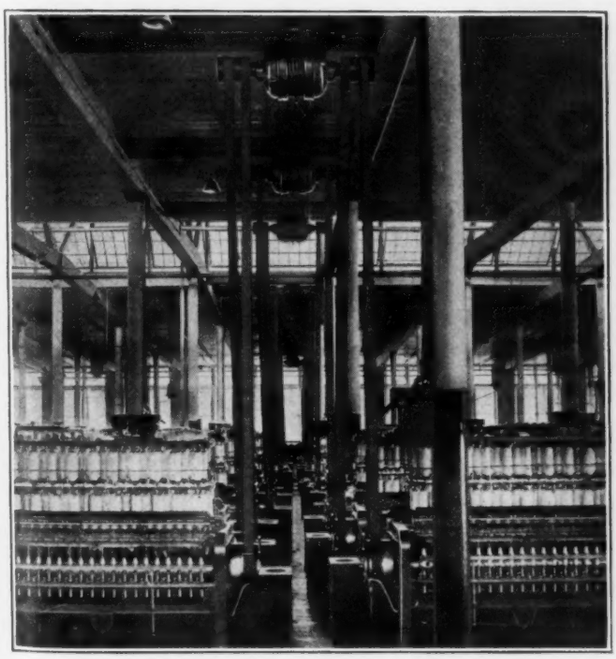
The first is a wound-rotor motor on slide rails; the second is a typical loom motor with the frame cast for conduit connection; the third shows a loom motor connected with a loom clutch; the last is a direct-current motor arranged for conduit wiring.

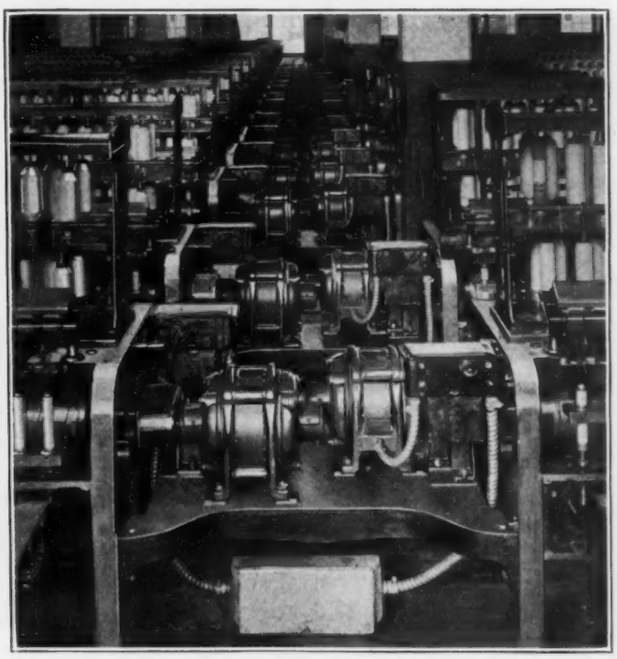
control manufacturers to design motors and control apparatus with characteristics which adapt them to the particular machinery to be driven. In the following paragraphs, therefore, the principal points to be discussed are those which relate (a) to the types of motors now available for such service, (b) to interesting aspects of modern control apparatus for textile motors, and (c) to cases selected from actual practice which illustrate given motor applications.

From some standpoints the direct-current motor might be looked upon as suitable for textile machinery,

The practice of one leading motor manufacturer is to list these motors in two groups,[4] one group having a starting torque of at least three times full-load torque, and the other having starting torques ranging from one and one-quarter to two and three-quarters times full-load torque.

The slip for motors of this class varies somewhat with the service to which they are applied. Where uniform speed is required the motor is designed for a slip of about 4 per cent at full load. However, where the motors seldom, if ever, operate at less than half





FIGS. 5 AND 6—FOUR-FRAME BELT DRIVE AND INDIVIDUAL MOTOR DRIVE WITH GEAR CONNECTION

at least in many cases. The presence of lint and dust in the air, however, has had a tendency to increase the use of induction motors for such service. The constant deposit of dust and lint in the crevices of the motor and in uncovered bearings is such a serious objection that motors have been designed for the complete protection of the interior of the frame, the windings, bearings and oil wells.

load the actual gross speed variation is thus only about 2 per cent.

The tendency in the application of these motors is

[4]Catalog 3002, Section 1, p. 44, Westinghouse Electric & Manufacturing Company. Figs. 3 A and B, 5, and 7 A, B, C, E and G are shown by courtesy of this company; Fig. 4 A of the Wagner Electric Manufacturing Company; Figs. 7 D and F, of the Crocker-Wheeler Company; and Figs. 1 and 6, of the General Electric Company. Data and other information have been contributed by these companies.

for individual drive, which possesses decided advantages over the group method. Sometimes, however, a single motor may be used for driving a group of textile machines according to the usual group method, as shown, for example, in Fig. 5. In a case of this kind it is unnecessary to use line shafting.

In addition to the general precautions taken in the design of textile motors, as outlined above, for preventing the accumulation of dust and lint on operating parts of the motor, consideration is also given to other peculiar conditions found in the various departments of textile mills. Among them are the fire risk in picker rooms, the presence of acid fumes in the dye house, etc.

Typical loom motors are adapted also to such cases as warpers and winders, and special types are available for the class of machinery typified by the picker and the roving frame. To meet particular conditions in yarn mills the double-extended shaft and the four-frame-drive have made it possible to drive four machines from one motor without line shafting.

Finally, some cases are found, as in finishing processes, where different qualities of goods worked upon call for different speeds. In such cases either the direct-current adjustable-speed motor or the wound-rotor alternating-current induction motor is used. The former is preferable where wide ranges of speed are necessary and also in cases where a number of productive machines are arranged in series, each equipped with its own individual motor, but the entire series controlled from one point.

Where starting conditions permit, synchronous motors may be used in conjunction with the standard induction motor equipment, a feature which is specially desirable in case the power factor of the induction-motor circuits is low.

The advantages of the motor depend to a considerable extent on the control facilities available. For individual drives a non-automatic "quick-make-and-break" oil switch (Fig. 7G) may be employed. The protective features of standard textile switches include overload protection only in some cases, low-voltage protection only in others, and both features in still others.

For frequent starting and stopping, and also where push-button operation is required, the practice is to make up regular contactor panels for the conditions of any given case. In those mills where central-station power is purchased rules of the power company may not permit the starting of induction motors by throwing them directly on the line. In such cases starting switches like Fig. 7G may not meet the requirements and an auto-starter becomes necessary. With these starters overload and low-voltage protection is available, together with arrangement for conduit. Where direct-current adjustable-speed motors are used for a series of productive machines operated from a central point automatic or semi-automatic control is advisable.

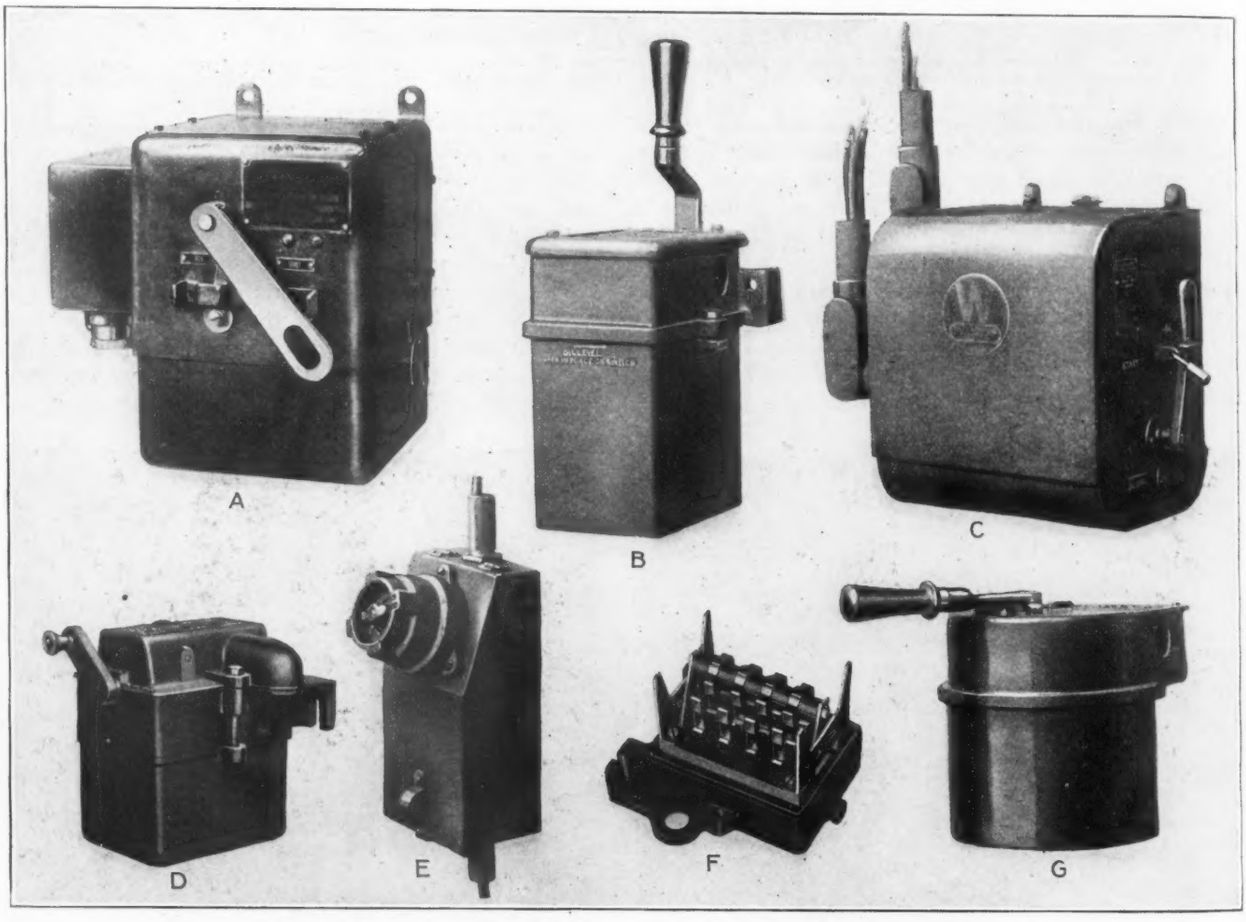


FIG. 7—DIFFERENT TYPES OF TEXTILE MILL MOTOR CONTROLLERS

A—Quick-make starting switch designed for conduit connection and provided with inverse-time-limit overload and low-voltage release; readily mounted on wall, post or ceiling. B—Another type of textile switch. C—Auto starter. D—Switch for loom motor showing operating lever at front. E—Special snap switch with fuses designed for conduit wiring. F—Interior of switch D. G—Starting switch designed for conduit wiring.

The agitation in the press at the present time concerning the textile situation places unusual emphasis on the small margin of profit derived by such concerns in comparison with some other industries. This being the case, there is every reason for the manufacturers of textiles to investigate each possible channel through which increased production may be realized for given manufacturing expense. Recent data indicate a rapid increase in the adoption of the motor for textile mills, and those responsible for the power supply will do well to take advantage of the developments which have been made in the design of motors and control for the various classes of machinery which are met with in plants of this description.

The experience of the immediate past points to a gradual reduction in the capital required per unit of manufactured value of textile products. Every per cent of reduction along this line means just so much more leeway for the operators in profit margin, and the possibility of improving wage conditions.

A Study of Electric Range Efficiency*

Results Obtained by Means of Tests Made on Both Open and Inclosed Heating Units with Different Kinds of Utensils, as Well as from Experiments with Ovens of Different Size

BY R. G. KLOEFFLER

Assistant Professor in Electrical Engineering, Kansas State Agricultural College

AN INCREASED interest in the efficiency of the electric range has recently become evident. This has been the natural result of the widespread introduction of this modern cooking appliance during the last three years. The cost of operation is the thing which interests the prospective owner of an electric range and the central station supplying the electrical energy. The cost of operation and efficiency, however, are almost synonymous when applied to electric cooking.

In order to determine the efficiency and practicability of the electric range a series of tests was carried on during 1917 in the electrical engineering laboratories of the Kansas State Agricultural College. The important results of this investigation are presented below. Details of these tests and complete data will be published in *Bulletin No.* 9 of the Engineering Experiment Station of the Kansas State Agricultural College.

SURFACE-HEATING UNITS

The efficiency of surface-heating units was obtained in a simple manner, as follows: One quart (0.94 l.) of distilled water at a temperature of 60 deg. Fahr. (15.6 deg. C.) was placed in a covered dish upon a unit. Current at a constant potential of 110 volts was turned on the unit (beginning cold) until the water rose nearly to the boiling point (206 deg. Fahr., or 96.7 deg. C.) as registered by a mercury thermometer. At the same time the energy consumption was recorded by a standardized watt-hour meter. The energy in B.t.u. utilized is the product of the pounds of water and the change in temperature, while the energy input (B.t.u.) is the product of kilowatt-hours and the constant, 3415. Efficiency = [pounds water $\times$ change in temperature (Fahr.)] $\div$ [3415 $\times$ kilowatt-hours].

If the water should reach the boiling point and boil for some time, the efficiency could be again obtained with fair accuracy by reweighing the water and adding to the previously computed absorption that required to change the water into steam; thus: Efficiency = [pounds water $\times$ change in temperature + pounds evaporated $\times$ latent heat of evaporation] $\div$ [3415 $\times$ kilowatt-hours].

According to these methods, the efficiencies of the surface units on eight different electric ranges were computed. Seven of these units are shown in Fig. 1. The eighth was omitted because of the difficulty in classifying it for the general work of comparison. The three units at the top of Fig. 1 are of the inclosed or disk type. The lower units are of the open or radiant type.

It might be expected that the efficiency would vary with the size, color and material of construction of the utensil used in the tests. In order to get an average value for such variations and also to get the data for desirable comparisons, the following utensils were

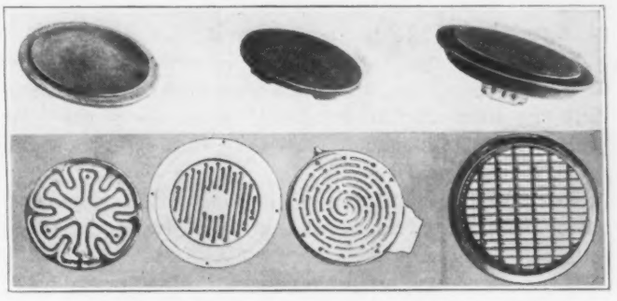


FIG. 1—INCLOSED AND OPEN UNITS FOR ELECTRIC RANGES

chosen: a small bluish-gray granite kettle having a diameter of 6 in. (15.2 cm.) on the bottom; a small aluminum kettle 6 in. (15.2 cm.) in diameter called "new" in this article since it had a bright, new luster and a perfectly flat bottom; a small aluminum kettle same as above except that it was discolored with use and dented at the bottom (called old); an aluminum fireless cooker pan 8 in. (20.3 cm.) in diameter and having a perfectly flat bottom (called new); an agate granite pan and a white granite pan each having a diameter of 8 in. (20.3 cm.) on the bottom. All of the above utensils were fitted with suitable covers before the experiments began.

The efficiencies on the seven units illustrated are

*Copyright, 1918, by R. G. Kloeffler.

condensed into Tables I, II and III for the purpose of specific comparisons.

Table I gives the values of surface unit efficiencies for granite and new aluminum utensils on the open and on the inclosed type of surface units. From the average percentages it is observed that the open type has 4.9 per cent more absolute efficiency when used with granite than with aluminum utensils. This figure relative to the efficiency with aluminum makes the granite utensils 12.7 per cent more efficient.

TABLE I—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	6-In. Granite	8-In. Granite (Agate)	6-In. Aluminum (New)	8-In. Aluminum (New)	Average for Granite	Average for Aluminum	Average for All
Open	35.6	42.7	33.3	37.5	39.15	35.4	37.27
Open	43.6	52.4	33.3	43.5	48.0	38.4	43.2
Open	36.8	46.2	32.2	43.3	41.5	37.5	39.5
Open	42.4	47.2	37.2	47.9	44.8	43.55	43.67
Average	39.6	47.1	34.0	43.05	43.35	38.45	40.91
Inclosed	29.7	43.2	36.6	49.1	36.45	42.85	39.65
Inclosed	46.4	41.2	53.3	48.7	43.8	51.0	47.4
Inclosed	29.5	41.5	37.1	54.9	35.5	46.0	40.75
Average	35.2	41.97	42.33	50.9	38.6	46.6	42.6

TABLE II—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	6-In. Aluminum (New)	6-In. Aluminum (Old)	8-In. Aluminum (Covered)	8-In. Aluminum (Open)	30-Minute Test (Granite)	30-Minute Test (Aluminum)
Open	33.3	28.4	37.5	34.4	58.9	51.5
Open	33.3	33.6	43.5	34.2	58.7	51.2
Open	32.2	31.4	43.3	31.4	55.0	55.8
Open	37.2	32.8	47.9	39.3	55.7	60.8
Average	34.0	31.55	43.05	34.8	57.07	54.8
Inclosed	36.6	22.9	49.1	42.4	60.0	67.8
Inclosed	53.3	37.8	48.7	43.75	50.3	63.5
Inclosed	37.1	25.2	54.9	51.5	57.5	72.9
Average	42.3	28.6	50.9	45.9	55.9	68.1
General average	.....	.....	46.97	40.35	.....	.....

For the inclosed type of unit, however, the reverse of the above is true, and the average percentages show that the new aluminum utensil gives an 8 per cent higher absolute efficiency than the granite. This value in terms of relative efficiency makes the aluminum utensil 20.7 per cent more efficient. For the purpose of easier comparison the results of Table I are plotted in the chart (Fig. 2).

These facts can be explained in the following way: The open-type units give up their heat principally by radiation, though some convection and conduction will take place. On the one hand, the granite dishes will readily absorb the radiated heat, while the aluminum, if bright, will have a tendency to reflect the radiated heat downward again. On the other hand, the inclosed unit gives out most of its heat by conduction, with smaller amounts emitted by radiation and convection. Here the granite dish, because the coating of enamel is a poor conductor of heat, does not receive the heat readily while the aluminum dish, since aluminum is an excellent conductor of heat, acts more efficiently.

Columns 2 and 3 of Table II give the efficiencies on an old and a new 6-in. (15.2-cm.) aluminum utensil. For the open type of unit the new aluminum utensil has an average absolute efficiency of 2.45 per cent more than for the old, and therefore the former is relatively 7.75 per cent more efficient. This percentage is to be contrasted with that of the inclosed group of units, where a difference of 13.7 per cent in absolute efficiency is noted; that is, relative to the old aluminum utensil the new one is 48 per cent more efficient. The efficiencies of this part of the table for the old aluminum utensil are also plotted in the chart of Fig. 2. It will be observed that the second open type of unit has a slightly higher efficiency with the old aluminum utensil than with the new one. This occurs because this unit, being of the reflector type, will absorb the heat more readily from the darker-colored utensil bottom. A study of Fig. 2 gives the inclosed units the maximum of all the efficiencies obtained, when used with the new aluminum utensils, but the big reduction in comparative efficiencies as the bottom of the utensil becomes discolored and dented offsets this advantage.

Columns 4 and 5 (Table II) show the efficiencies with and without a cover on the utensil. For the open type of unit the cover adds an average of 23.7 per cent to the relative efficiency; for the inclosed type the relative efficiency is increased by an average of 10.9 per cent, and for all seven units the average increase is 16.4 per cent.

Columns 6 and 7 of this table contain the computed efficiencies when, after being heated for thirty minutes, the utensil remains on the unit until the boiling of the water has ceased. A study of the averages here reveals that the inclosed units give the higher values, which might be expected since the heat stored in the iron mass of the inclosed unit will be readily given up by conduction.

TABLE III—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	8-In. Agate Granite (Weight, 0.86 Lb.)	8-In. Blue Granite (Weight, 1.5 Lb.)	8-In. White Granite (Weight, 1.5 Lb.)	8-In. Blue Granite, 3 Qt. Water
Open	47.2	45.8	44.6	50.7
Open	52.4	50.7	50.0	57.2
Incosed	43.2	40.2	39.1	46.3
Average	47.6	45.6	44.6	51.4

	1100-Watt Unit		1500-Watt Unit	
	Time	Efficiency, per Cent	Time	Efficiency, per Cent
Open	17 min. 20 sec.	52.4	15 min. 30 sec.	47.1
Open	21 min. 5 sec.	46.2	18 min. 20 sec.	39.4
Open	21 min. 8 sec.	45.8	16 min. 38 sec.	42.5
Average	19 min. 51 sec.	48.1	16 min. 40 sec.	43.0

Utensil	New Reflector	Dirty Reflector
6-in. granite	44.7	43.6
6-in. aluminum	36.9	33.3
8-in. aluminum	47.5	43.5
8-in. granite	55.3	52.4
Average	46.1	43.2
Per cent decrease in efficiency	....	6.3

The first section of Table III gives a comparison of an agate, a dark-blue and a white granite dish, all containing 2 quarts (1.9 l.) of water. It might be expected that the color of the enamel would affect the amount of heat absorbed, particularly on the open type of unit. The results seem to bear this out, though the

difference is rather small. This does not explain the same difference found in the case of the inclosed unit. The last column in this section gives the efficiencies on the blue pan when 3 quarts (2.8 l.) of water are used. As expected, the efficiency increases with the quantity of water and the time required for a given change of

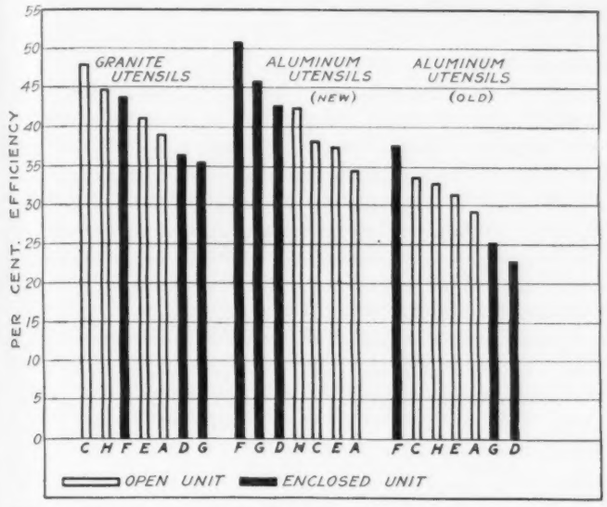

GRANITE UTENSILS
ALUMINUM UTENSILS (NEW)
ALUMINUM UTENSILS (OLD)
PER CENT. EFFICIENCY
C H F E A D G F G D H C E A F C H E A G D
OPEN UNIT
ENCLOSED UNIT

FIG. 2—CHART PLOTTING PART OF TABULATED DATA (TABLES I AND II)

temperature. The average increase in efficiency here is the same for the open and for the inclosed type of units.

The second section of this table compares the efficiency and time required for a given rise of temperature of 2 quarts (1.9 l.) of water on 1100-watt and 1500-watt units. The average of the results shows that about three minutes in time is gained at a sacrifice of almost 12 per cent in efficiency by using the larger unit. Hence an effort to hasten results by using a surface unit of the higher wattage will increase the cost of operation.

The last section of Table III brings out the difference on units of the reflector type in efficiency obtained from a bright new reflector and the discolored, dirty reflector which results from use. The average for four utensils on two different units shows a decrease of 6.3 per cent in relative efficiency after being in service for a time.

Thus far consideration has been given only to the efficiency obtained on raising the temperature of water from 60 deg. to 206 deg. Fahr., which requires from fifteen to twenty-five minutes. It would also be of interest to know how the efficiency has varied from the beginning, and to get this variation in efficiency readings of temperature and kilowatt-hours were taken at three, six, ten and fifteen minutes from start on two of the utensils tested. From these values the efficiencies were computed according to the method previously described, and they have been plotted in curves of Fig. 3.

With the new aluminum utensil both the open and the inclosed units have an average efficiency of about 17½ per cent at the end of three minutes. Beyond the three-minute point the efficiency of the inclosed units rises very rapidly, approaching a maximum in about fifteen minutes. The curves on the granite utensil show that at the end of three minutes all the open type of units have about 22½ per cent efficiency, while the average of the inclosed type at the same period is only about 7½ per cent. It takes about eight minutes for the inclosed type to reach the efficiency obtained by the open type at the end of three minutes. The open-type units rise to an average of nearly 40 per cent in the first ten minutes. The particularly rapid rise of unit C to almost a maximum in ten minutes should be noted, since there are some hasty operations in the kitchen where the surface unit may be in use for only five to eight minutes. This is more especially true where hot water is available at the tap. For such operations obviously the surface unit with the higher efficiencies obtained in a short time has a decided economical advantage.

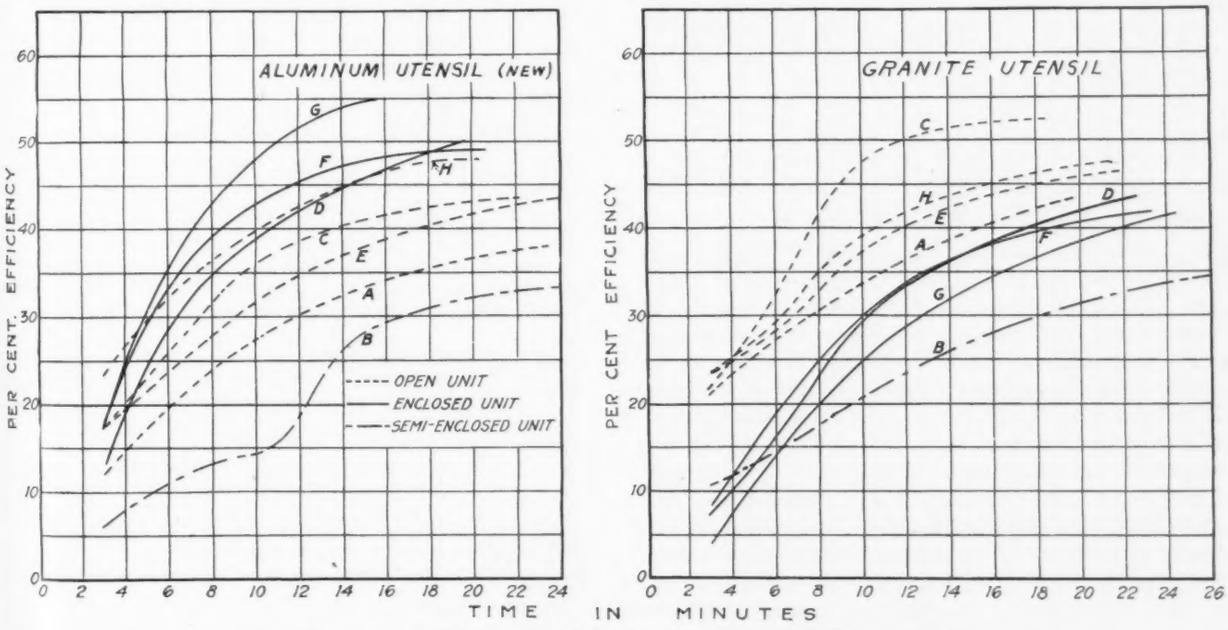


FIG. 3—CHART PLOTTING EFFICIENCIES AT STATED INTERVALS OF TIME

In a future issue of the ELECTRICAL WORLD data and tables on the performance of electric ovens will be printed.

STATION & OPERATING PRACTICE

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INTERESTING INSULATION TEST ON STEAM DRUMS

Experiment Showed that with Proper Heat-Insulating Material a Saving Resulted That Paid for This Extra Insulation

An interesting test for determining loss of heat by radiation from boiler settings and steam drums was recently made by C. A. Eastwood, superintendent of Station A, Pacific Gas & Electric Company, San Francisco, Cal. For the experiment a 560-hp. B. & W. boiler was selected, the steam drums of which were covered with one course of common brick. A rectangular can containing a measured quantity of water was placed on top of one drum and the boiler was run at its rated capacity for a period of three days. During this time the rise in temperature of the water was carefully noted.

To determine how much of the fuel loss could be saved by the use of an effective heat-insulating material, one 2½-in. (6.4-cm.) course of Armstrong nonpareil insulating brick was then placed on top of the common brick covering and readings were taken as in preceding tests. The result showed that with the nonpareil brick in place the loss of heat amounted to only 144 barrels of oil per year. With oil costing 70 cents per barrel, the saving amounted to more than enough to pay for the cost of the insulating brick and the labor required for installing it.

USE OF LIGHT-WEIGHT MOTORS A MEANS OF ECONOMIZING

Large Quantities of Copper and Steel Will Be Released Thereby for Other Purposes—Freight on Light Motors Less

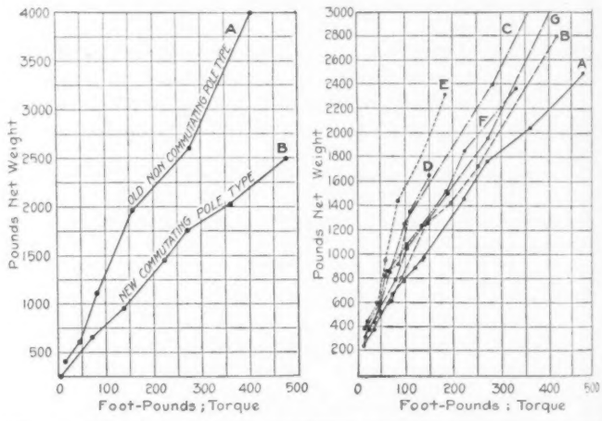
BY A. BRUNT
Engineer Westinghouse Electric & Manufacturing Company

Economy with all the resources of the country is of the greatest importance under the present conditions, it being just as important to economize with copper and steel as it is to economize with food and coal. In order to pay off the immense war debts it will be imperative for this country to make the best possible use of its resources. Of these copper and iron ore form very prominent parts. Economy in these metals must be made at every point, and no part of a machine should contain metal not necessary for its proper operation. By giving preference to lighter motors of equal rating users will encourage manufacturers to seek out means of economizing metals and thus release a very substantial amount for other uses.

Records of a prominent manufacturing concern indicate that the average-size direct-current general utility motor sold has a torque of 65 ft.-lb. (8.97-kg.-m.), corresponding to 15 hp. at 1200 r.p.m. This size of motor can be bought with a weight varying between 605 lb. and 1080 lb. (274.4 kg. and 489.8 kg.) (Fig. 2). Assuming the average weight of motors of 65-ft.-lb. (8.97-kg.-m.) torque to be 845 lb. (383.3 kg.), and further assuming a total production in this country of 30,000 motors per year, the waste of material by using the average motor instead of the lightest motor will be (845 — 605) × 30,000, or 7,200,000 lb. (3,265,865 kg.) per year. This figure is appalling, especially under present conditions.

Improvements in the design of direct-current motors —chiefly the adoption of the commutating pole, a more thorough knowledge of allowable operating temperatures and more effective means of ventilation—have made it possible for progressive manufacturers to reduce the weight of their machines very substantially (Fig. 1).

Since all manufacturers sell in the same market, their prices for motors of the same rating must necessarily be nearly the same. The purchaser of a motor naturally will ask, "Should I buy the light or the heavy motor?" The motors will all be designed to have the same temperature guarantees, and, assuming that the speed characteristics will be satisfactory and the efficiencies equally good, it may be asked, What are the advantages of the one over the other?



FIGS. 1 AND 2—RELATION BETWEEN WEIGHT AND TORQUE FOR COMMUTATING-POLE AND NON-COMMUTATING-POLE MOTORS; ALSO FOR SEVEN VARIOUS MAKES OF MOTORS

Naturally many purchasers of direct-current motors will think that by buying the heavy motor they are getting more for their money. A careful comparison of the two motors, however, will show that this is not so. If the heavy motor should have more excess capacity, this should also show itself in dimensions of shaft and bearings. However, an examination of the pulley-end bearing diameter for two competitive lines of motors manufactured by prominent concerns shows that there is very little difference between shaft diameters of competitive motors.

The lighter motor necessarily must be the better ventilated one, which means that the motor is so con-

structed that the cooling air comes in thorough contact with those internal parts in which the heat is generated. Thus it follows that the excess of actual external temperature over the temperature measured by applying a thermometer to outside surfaces must be smaller in the light, well-ventilated motor than in the heavy motor, with consequent smaller danger of damage to the insulation. In this respect the light, well-ventilated motor is much to be preferred over the heavier one.

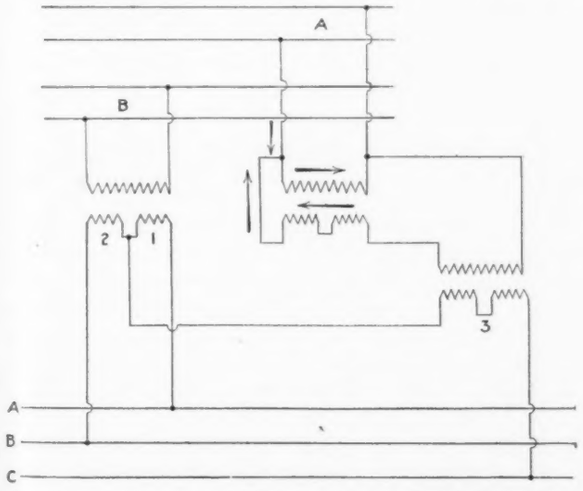
Light motors further can be handled more easily and also have a lower freight rate, which is an advantage to the purchaser in case the motor is to be shipped outside of a free-delivery zone. That great weight is not necessarily an equivalent of superior qualities is well illustrated by the weight curves of Fig. 1. Efficiency and especially commutation of the commutating-pole motor are decidedly superior to the same qualities of the very much heavier non-commutating-pole motor.

FROM TWO- TO THREE-PHASE WITH STANDARD TRANSFORMERS

Balanced Voltages by Connecting Two Transformers in T and Using a Third to "Buck" Voltage Across Unit Corresponding to Leg of T

BY E. CHARLES SEARS

Where two-phase service is supplied and three-phase energy is desired, but only standard transformers are available, the following plan can be followed: Assume that the primary voltage is 2200 and that 2200/220-110-volt transformers are available. Connecting the primary windings of two transformers across the two phases and joining the secondary of one transformer with the mid-point of the other transformer's secondary will not give balanced three-phase voltages, since the secondary windings do not have the proper number of turns, relatively, for T-operation. In fact, operating



METHOD OF CONNECTING THREE STANDARD TRANSFORMERS TO CONVERT FROM TWO-PHASE TO THREE-PHASE

the transformers mentioned above in T the phase voltages* would be 228, 261 and 261.

By connecting a third transformer across phase A to "buck" the primary voltage of transformer 3 by 220 volts, however, the voltages across phases are made nearly equal, as shown by the following calculations: Voltages across both windings 1 and 2 were 110 volts and the pressure across winding 3 was 198 volts. Thus the voltage across windings 1 and 2 would be 220 volts, while both the other delta voltages would be

$$\sqrt{110^2 + 198^2} = 227 \text{ volts.}$$

*Based on actual measurements for a specific installation—voltages across windings 1 and 2 were both 114, while voltage across winding 3 was 235.

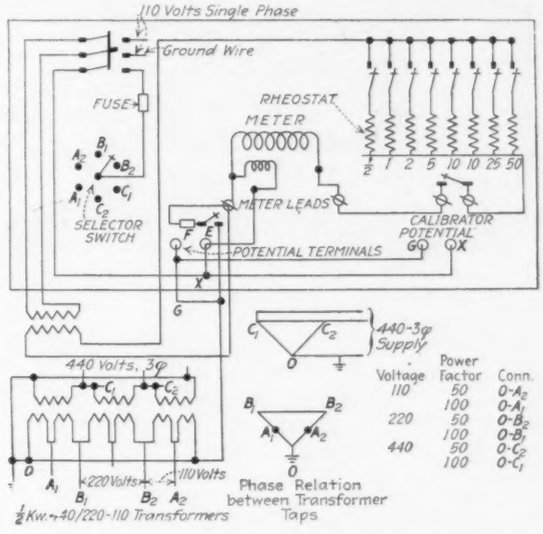
METHOD OF TESTING METERS AT TWO POWER FACTORS

Transformer Taps Provided to Give 110-220-440 Volts and 50 and 100 per Cent Power Factor—Diagram of Connections

BY JOSEPH N. M'CLURG

Foreman Meter Department Scranton Electric Company

The writer recently developed a meter-testing panel for testing single or polyphase meters of 0.5-amp. to 100-amp. ratings at 110, 220 and 440 volts. The panel



WIRING DIAGRAM AND PHASE RELATION BETWEEN TRANSFORMER TAPS

is of transite wood. The main switch is a 60-amp. single-throw, triple-pole instrument, and the load switches are 30 amp. single-throw, single-pole. The load consists of old direct-current arc-lamp resistance coils connected with an old 5-kw., 2200/110-volt transformer operated at reduced voltage to obtain 20 volts on the secondary.

The selector switch gives 110-220-440 volts, 50 and 100 per cent power factor. The connections for giving different voltages and power factors are indicated in the accompanying diagram. Switch E is closed when testing single-phase meters, one potential lead being fastened to the line terminal of the series coil in the meter. This switch is opened if the potential coil is not joined with the current coil. It has individual terminals.

From the vector diagrams at the bottom of the illustration it may be seen that if the load current is in phase with vector OC_1, OA_1 or OB_1, 100 per cent power factor will be obtained by connecting selector switch with contact A_1, B_1 or C_1, the voltages being 110, 220 and 440 volts respectively. When connected with A_2, B_2 or C_2, however, the voltage is 60 deg. out of phase with the current, so 50 per cent power factor will be obtained.

SAFETY BULLETIN BOX FOR PREVENTION OF ACCIDENTS

Provides Receptacle for Suggestions, Display of Safety Council Bulletins and Opening for Lantern Slides

The United Gas Improvement Company of Philadelphia has developed the safety bulletin box shown herewith to attract the attention of its employees. In addition to serving as a receptacle for suggestions, the box provides a new arrangement for the display of standard letter-size safety-council bulletins. There is also a standard opening for lantern slides and descriptive notes, which are made prominent by a flashing light. The box is strongly made of light sheet metal and contains a flashlamp, double glass sides, necessary electrical connections and a short section of insulated

BULLETIN BOX FOR PROMOTION OF SAFETY

cable which may be extended through an insulated bushing at the upper corner on either side of the box. The exterior is enameled in safety green, and the interior is painted in aluminum. The box measures 12 in. by 22 in. by 20 in. (30.5 cm. by 55.9 cm. by 50.8 cm.).

THE TREMENDOUS FORCE EXERTED BY SHORT CIRCUIT

Conductors and Insulation Expelled from Sheath—Bulge Produced in Cable 150 Ft. from Point of Rupture

BY GEORGE W. TEFFEAU

Some indication of the enormous force exerted when a short circuit takes place close to a station was given recently when cable trouble occurred on the lines of a large Western company. In searching for the damage done a slight bulge was observed on the joint sleeve where the cable joined a submarine cable. The joint was opened and it appeared that the conductors had been crowded forward into the joint 2 in. (5.1 cm.).

On testing the damaged submarine cable from the street end it was found that the conductors showed all three legs short-circuited and grounded, while a test from the station end showed the three conductors short-circuited but free from ground, indicating that the cable had burned apart. Resistance tests indicated that the failure had taken place three-quarters of the way between the station and the street end. The cable was dug up at this point, the break discovered and the cable found to be damaged for a distance of about 4 ft. (1.2 m.), with no damage to adjacent cables. At the point of failure the lead sheath and steel jacket were badly ruptured, while on the station end the copper conductors with their paper insulation had been forced out of the lead jacket for a distance of 2 ft. (0.6 m.). The mighty force which caused the rupture was great enough to push the cable in its jacket of steel forward, causing the bulging in the sleeve referred to before. The distance between the failure and the sleeve was 150 ft. (45.7 m.).

TEST POINTS IN SERIES CIRCUITS SAVE TIME

Installation of Test Points Required Modification of Trouble-Hunting Methods—Details of Methods and Instructions Given

Suitable test points in series circuits are time savers in trouble hunting. One central station which recently changed from inclosed carbon arcs to Mazda C units modified its overhead construction at the same time to minimize line trouble. The first improvement was the installation of absolute cut-outs at the lamps. This not only made patrolling and renewals safer but also permitted the service wires to each lamp to be pulled up tight permanently, since these wires no longer swung down when the lamp was lowered. As it was no longer necessary to provide for clearances with cross leads in lowering the service wires, vertical runs on poles were obviated and construction on poles was much simplified. Further safety was secured by the use of duplex feeds.

However, the new installation required a modification of trouble-hunting methods previously in force. Patrolmen looking for grounds or opens had made a practice of lowering an arc into the street, disconnecting a terminal and ringing out in the usual way to ground. The new absolute cut-outs precluded this method, and even where cut-outs were not installed it was impossible to trace back through the duplex feed. It was therefore decided to install test switches at convenient points. These consist of ordinary knife-type "disconnects" suitably chosen for outdoor service at the maximum voltage of the constant-current circuit. Shorter circuits are divided into five parts by four switches, longer into seven or more sections. Switches are, where possible, mounted on poles where both sides of the circuit are available, since this aids in trouble location. A ground pipe is driven at the base of the switch pole and a ground wire is run up the pole to a point near the switch and terminated in a connector convenient for testing. Instructions to trouble men using sectionalizing switches are as follows:

Ground.—Have substation operators clear circuit terminals. Open sectionalizing switch and ring out each side to ground connection with a magneto. Grounded section rings. If there are two switches on test pole, open both, thus cutting circuit into three sections.

Open Circuit.—Have substation operator ground circuit terminals. Open sectionalizing switch and ring out each side to ground connection. Open section will not ring. If there are two switches on test pole, open both and ring terminals toward substation. If both ring, break is in loop beyond switches. Check this by attempting to ring across loop terminals.

Short.—Trace by observing dead lamps.

Cross.—Open sectionalizing switch or switches and test for hot section by grounding.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

RATES FOR THAWING FROZEN WATER PIPES

Average Return per Service in Binghamton, N. Y., Is Approximately $13—Eighty Jobs Are Undertaken in One Cold Week

Owing to the extremely cold weather which has recently been experienced there have been a great many applications made to central stations and contractors for thawing out frozen water pipes. During the week of Jan. 5 to 12 there were eighty requests for this class of work in Binghamton, N. Y. The Binghamton Light, Heat & Power Company's methods of accomplishing these thaw-outs have been very successful, and the practice is a source of revenue. The minimum charge for the work is $10 per service, to which is added $1 for each mile that the customer is from the company's stockroom, $1 for each 100 ft. (30.4 m.) that it is necessary to run service wires, and $1 for 0.5 in. (1.27-cm.) increase in size of pipe over 1½ in. (3.81 cm.). The average return from thawing a pipe by the electrical method is approximately $13.

HOW ONE CENTRAL STATION ENCOURAGES ECONOMY

Records of All Labor and Materials Are Kept on a Series of Forms and the Success of Each Foreman Is Checked

A scheme which encourages employees to economize time and material has been successfully developed by the Spokane (Wash.) Heat, Light & Power Company. The idea developed primarily in connection with construction work, but has been extended to include practically all operations where labor and materials are involved, even to firing boilers in the central heating plant.

The plan simply requires an advance estimate of the cost of any work to be done, and this estimate, embodied in a written work order, is given to the foreman or that employee who has the particular work in hand. Thus the work order becomes a bogie to the foreman and he endeavors to keep within it if he can. If he exceeds the figure set, he has to secure authorization for more expenditure, and his explanation of this situation brings out either (1) unforeseen conditions, which aid the estimating department in future work, or (2) evidence of waste which the foreman must clear up to the satisfaction of his superior.

The advantages claimed for the scheme are that, in addition to the actual money saving, the psychological effect is excellent. Foremen dislike to exceed estimates and be obliged to explain why, and on the other hand they take pride in keeping the cost below the estimate. There are also the advantages of an accurate record of costs conveniently arranged, an allocation of all charges for labor, a constant check on materials on hand, and a means of making up the payroll easily at any time by totaling work-order records.

There are several forms about which the system centers. These begin with a letter size form known as the A. F. E. ("authority for expenditure"—Fig. 1), on which are entered the name of customer and a brief statement of the work to be done, with a list of the more important items that will be required on the work. It also states the amount which the work is estimated to cost. Before this A. F. E. sheet receives a work-order number and the work is classified it must be signed by officials of the sales department and the accounting de-

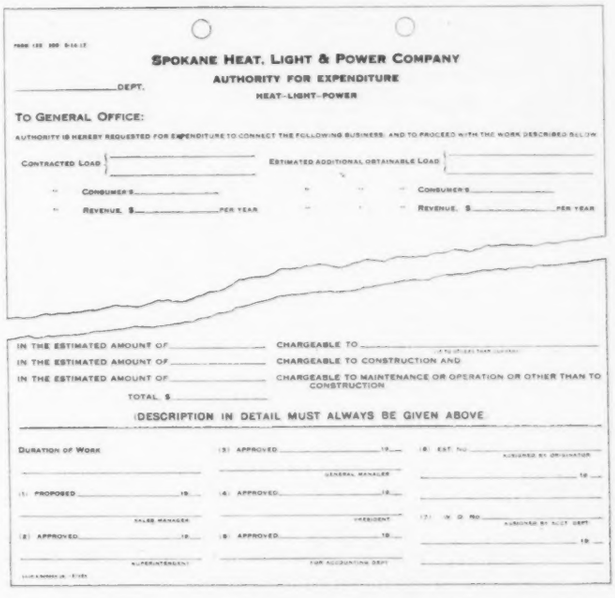

SPOKANE HEAT, LIGHT & POWER COMPANY
AUTHORITY FOR EXPENDITURE
HEAT-LIGHT-POWER
DEPT.
TO GENERAL OFFICE:
AUTHORITY IS HEREBY REQUESTED FOR EXPENDITURE TO CONNECT THE FOLLOWING BUSINESS, AND TO PROCEED WITH THE WORK DESCRIBED BELOW
CONTRACTED LOAD
ESTIMATED ADDITIONAL OBTAINABLE LOAD
CONSUMER'S
REVENUE, $ PER YEAR
IN THE ESTIMATED AMOUNT OF
CHARGEABLE TO
IN THE ESTIMATED AMOUNT OF
CHARGEABLE TO CONSTRUCTION AND
IN THE ESTIMATED AMOUNT OF
CHARGEABLE TO MAINTENANCE OR OPERATION OR OTHER THAN TO CONSTRUCTION
TOTAL, $
DESCRIPTION IN DETAIL MUST ALWAYS BE GIVEN ABOVE.
DURATION OF WORK
(1) PROPOSED
(2) APPROVED
(3) APPROVED
(4) APPROVED
(5) APPROVED
(6) EST. NO.
(7) W. O. NO.
SALES MANAGER
GENERAL MANAGER
PRESIDENT
SUPERINTENDENT
FOR ACCOUNTING DEPT.

FIG. 1—FORM USED TO EMBODY "AUTHORITY FOR EXPENDITURE" IN CENTRAL STATION OPERATION

partments, as well as by the estimator and some one in a managerial position, either the general manager or the president. These A. F. E. sheets are made out in triplicate, one copy going to the superintendent, who usually prepares the estimates, one copy to the engineering department and one to the accounting department. By using different colors the three forms are readily kept separate.

Next in order comes the work order (Fig. 3), a square 4-in. (10.16-cm.) slip, also made in triplicate, or which the most important entry is simply the work-order number. Of course, it also carries date and résumé of the work to be done. The copy of the work-order sent to the superintendent is on white paper and is simply his notification. It is not preserved or required again in the records. The yellow and blue copies, however, going to the accounting department and the foreman respectively are carefully kept, and by them the progress of the work is checked on the ledger

sheet. This sheet (Fig. 4), which enters the scheme at this point, is a page from a loose-leaf file. It also bears the work-order number which identifies each individual job all through the records and carries the accounting department's detailed record of all materials and labor. It carries the figure which the work was estimated to cost, so that as the items of labor and material charges to the job increase their total can be compared with the estimate for the job. Thus the approach to the limit is readily seen and checked with the progress of the work.

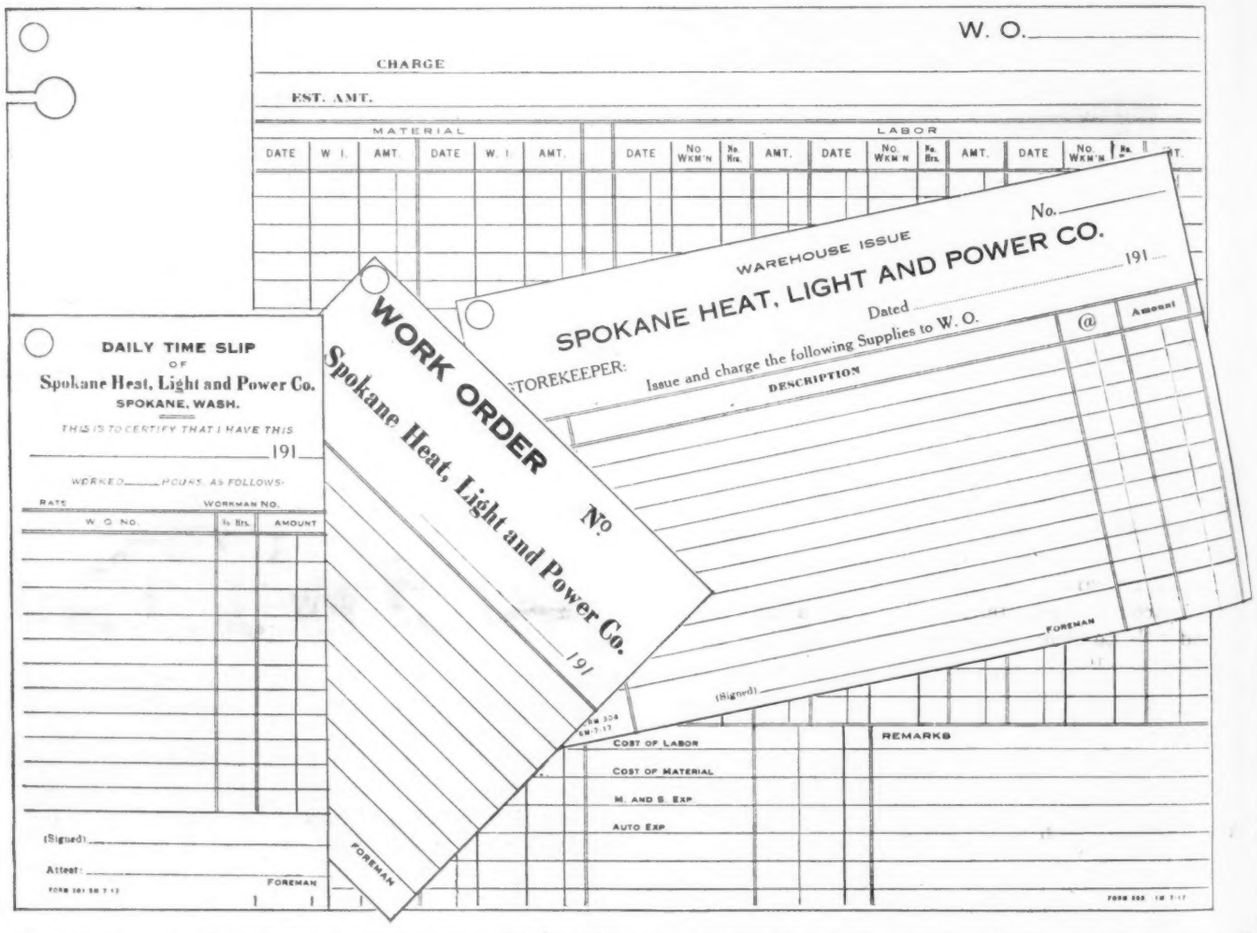
As soon as the accounting department gets a yellow work-order slip, this is attached to a blank ledger sheet made out for the job, thus showing that it has been approved for construction. When the work is finished the blue work-order slip, duly signed by the foreman, is also attached. Thus a glance through the file shows what work is authorized and what is completed.

When a foreman requires materials he gets them from the warehouse by signing a small form called a warehouse slip (Fig. 5), on which the materials are itemized and which bears the work-order number. This

small time slip (Fig. 2) filled out for every workman every day by his foreman. It bears the signature of workman and foreman and indicates the number of hours each man put in, the work-order number to which his work is to be charged and the total charge on each work order. The accounting department enters these data on the ledger sheet bearing the corresponding work-order number. Thus the system simplifies to the point that practically all data of permanent value are carried by the ledger sheet and a convenient means of completely checking the estimate, cost or progress of any job is thus afforded.

What are known as standing work orders are assigned to such work as firing boilers and any other plant maintenance work, so that the daily reports can be simplified and yet keep the records standard for all kinds of work in which the company uses labor and material.

The system is a new feature, having been worked out in its present form only a few months ago, and minor changes have been made in it up to a recent date. However, company officials express great satisfaction in its



FIGS. 2, 3, 4 AND 5—TIME SLIP, WORK ORDER, LEDGER SHEET AND WAREHOUSE SLIP USED BY PACIFIC COAST COMPANY TO SYSTEMATIZE OPERATION

is a notice of materials to be charged to a job and is sent to the accounting department and copied on the ledger sheet carrying the corresponding work-order number. Credit for materials returned from a job is later given on a similar slip and likewise listed on the ledger sheet.

One more form enters into the scheme. This is a

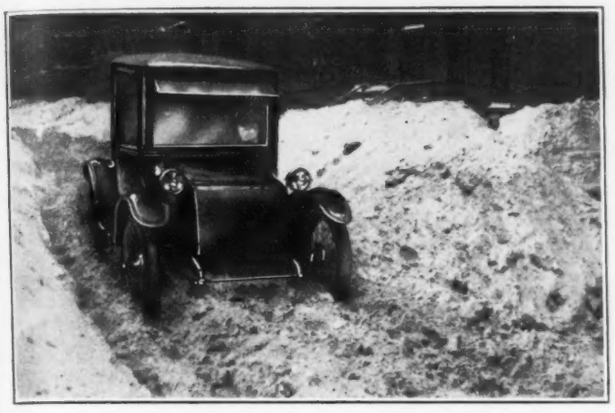
effectiveness and point to notable reduction in construction costs since its adoption.

The system described in the preceding paragraphs has been worked out by Ludwig Kemper, president of the Spokane Heat, Light & Power Company, in conjunction with H. W. John, who is secretary-treasurer of the company.

ELECTRIC VEHICLES MAKE RECORDS IN SNOW DRIFTS

Blizzards and Coalless Days in Chicago Fail to Tie Up Storage-Battery-Driven Passenger and Commercial Cars

Owners of electric vehicles in Chicago are enthusiastic over the "cold-weather" results that their cars have given this winter. Commercial car users have had considerable faith in the snow-fighting ability of their electric trucks, but such an opportunity as the recent



AN INSTANCE OF PARTICULARLY HEAVY GOING THROUGH BLIZZARD-STRICKEN STREETS

blizzards afforded for the supreme trial of the trucks has not been given the owners before. The trucks and passenger cars came out of the tests successfully, and as a result have gained more stanch supporters.

The firm of Case & Martin, a pie company, has operated sixty-three trucks through two severe blizzards in which the snow has drifted to depths of from 3 ft. to 10 ft. (0.9 m. to 3 m.) all over the city. In spite of these severe conditions the trucks have made from 32 miles to 52 miles (51 km. to 83 km.) a day. The regular trips to Evanston, Oak Park, West Pullman and other suburbs were made daily. Marshall Field & Company stated as their experience that the electric trucks on short hauls in the city would conquer drifts that gasoline cars would not dare attack. When snow did clog around the battery box and stop a car the drivers had only to clear the snow away from the box, put a small shovelful of ashes under the wheels and go ahead. When some of the company's big gasoline trucks stuck in drifts on the south side of the city an electric was sent out to pull them out, and succeeded in the job. The company has maintained two deliveries a day in spite of the weather, except on the two days when there was no street traffic. The cars averaged 30 miles (48.2 km.) a day in the snow.

How Snow Plows Were Hauled

The Commonwealth Edison Company used one of its trucks in an ingenious manner to pull a snow plow. No truck could pull a plow through the drifts with a direct hitch. In fact, it was a feat for a truck to get through itself. This particular vehicle was fitted with a winch for pulling cable. In its snow-plowing operations it would plunge through the drifts for a few hundred feet, its drivers would dig down to a manhole and anchor the truck. Then the snow plow attached to the end of a hauling line would be pulled up to the truck by the cable-pulling winch. This operation was repeated over the full length of street to be cleaned.

In the passenger-car field equally satisfactory service was given. Harry Salvat, president of the Fashion Automobile Stations, reported that his men were skeptical about sending out customers' cars. Mr. Salvat was not skeptical. Taking his own car, without even equipping it with chains, he went out the first morning after the heavy snowfall and drove 52 miles (83.7 km.) through the drifts. Since that incident all of the Milburn cars operating out of the Fashion garages have been continuously in service. But, what is more important, every employee of the Fashion stations is now enthusiastic about electric cars. On coalless days the Fashion company's battery-exchange plan proved its worth, permitting customers to get charged batteries at any time without violating the Garfield order.

Good Record at Detroit

The Anderson Electric Car Company also reported that its customers found no difficulty in negotiating the deep snows anywhere in the Middle West. A. C. Downing, who went to the Chicago Automobile Show after a trip from Detroit through Louisville, Ky., Evansville and Indianapolis, Ind., stated that the performance of electric cars in the snow has surprised even the Detroit company's agents. At Detroit the company after the first severe snowfall telephoned customers telling them to go ahead and use their cars and to call the factory for aid if they got into trouble. As the result of this the company had only four "pull-ins" in Detroit, as against seventy-eight "pull-ins" which a certain eight-cylinder gasoline car with an equal number of cars out had to its credit. At Evansville, Ind., the company's dealer enlarged its list of prospective customers by going into the residential districts on mornings when other means of transportation failed and inviting pedestrians to ride downtown.

From the owners of electric cars the statement is

ELECTRIC TRUCK PULLING SNOW PLOW TO CLEAR STREET FOR OTHER VEHICLES

heard in all quarters that the cars will pull through almost any depth of snow. This takes a little more energy than usual, but that is true of any car. The usual speed will not be attained, but with the condition of the streets as it is after a blizzard the electric will go as fast as it is safe to drive.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Iron Commutators.—FREDERICK MURGATROYD.—The fact that war conditions in Germany have necessitated a limitation of the use of copper and enforced the manufacture of iron commutators in certain classes of machines raises the whole question of the commercial possibility of iron for this use after the war. Presuming that an iron commutator will always be cheaper than one made of copper, then, provided there are no insuperable commutation or mechanical difficulties in operation, it can be safely assumed that the iron commutator as a commercial proposition has come to stay. The author points out that while British engineers will naturally watch developments in Germany, it would be wise for manufacturers in England to tackle seriously the question of iron commutators on their own account. The problem appears to be one for the brush engineer to solve. Sparkless commutation would be attained with much greater difficulty in view of the increased reactance voltage and the extra attention required to maintain a good polished commutator surface. With regard to the difference in friction coefficients and contact drops as a result of the change from copper to iron, it may be noted that German experience seems to show that there is practically no difference in the temperature rise of iron and copper commutators working under identical conditions. Whether this should be taken as a fact, or whether German engineers are merely making a virtue of necessity, is certainly doubtful. That iron commutators would require careful watching in operation is obvious, and in certain situations, such as in hygroscopic atmosphere, the formation of rust may forbid the adoption of iron. Trouble may occur with recessed mica owing to an accumulation of rust or of an oil-and-rust paste in the slots of the segments, but this is a detail which should not present any great obstacle.—London *Electrical Review*, Jan. 18, 1918.

Parallel Performance of Static Transformers.—Remarks made upon an article on this subject in the *Revue Générale de l'Electricité* for Sept. 29, 1917. It is entirely possible, the writer holds, to manufacture transformers that will operate in parallel with existing equipment if attention be paid to the following points: (1) Strength of the apparatus; (2) polarity; (3) short-circuiting voltage; (4) ratio of transformation with no load; (5) ratio of transformation with load; (6) resistances of primary and secondary windings; (7) ohmic fall of voltage or output and losses when operating at no load.—*Revue Générale de l'Electricité*, Jan. 5, 1918.

Lamps and Lighting

Calculations in the Use of Projectors.—WALDO C. COLE.—In the protection of industrial plants as well as in ornamental illumination the question of how many projectors to use at a given distance is one of the utmost importance. A combination of theoretical calculations under ideal conditions corrected by practical factors produces very accurate results, according to the problems considered by the author. The curve presented for the determination of light intensity at given distances should prove of great value in actual use.—*Journal of Electricity*, Jan. 15, 1918.

Problems of Factory Lighting. — ROMAINE W. MYERS.—The speeding up of production processes by means of more adequate shop lighting is always a live subject with electrical men, and to-day it has come to be one of the important war services. The article in question is on the elements of successful illumination as applied to the shops of the Judson Manufacturing Company of Oakland, Cal. The author points out that the proper maintenance of a good lighting system after installation should be carefully considered. The deterioration of tungsten lamps and reflectors due to accumulations of dust on the lamp and reflector surfaces amount to as much as 40 per cent if not properly cleaned. In one installation it was found under test that 25 per cent of illumination was lost by the accumulation of dust on the lamp alone.—*Journal of Electricity*, Jan. 15, 1918.

Generation, Transmission and Distribution

Emergency Substitutes for Coal.—J. F. SPRINGER.—The author points out that when a shortage of coal occurs the factory that is equipped to utilize a substitute is not likely to suffer much delay, for the other kinds of fuel are certain to be available. He tells the characteristics of these substitutes for steam coal: Fuel oil, tar, natural gas, producer gas, charcoal, coke from refuse coal, powdered coal from refuse, and refuse coal.—*American Industries*, January, 1918.

Design of High-Voltage Insulators.—C. E. OAKES.—(Third installment.) The author takes up the effect of the application of high frequency to porcelain insulators. A summary of insulator requirements follows: (1) Sound vitrification, resulting in high-puncture strength and low porosity, obtained by better manufacturing methods. (2) The highest surface resistance that is compatible with other requirements. A high surface resistance should not be obtained at the expense of short air spaces between petticoats or flanges. A uniform distribution of electrostatic stress is as important as high-surface resistance. (3) A uniform distribution of stress obtained by a symmetrical arrangement of metallic surfaces. (4) Provision of large air spaces at the junction of petticoats in the pin types. (5) As far as possible the air and porcelain, being dielectrics of different constants, should not be placed in series. (6) Provision of the maximum thickness possible together with the requirements in (3). The voltage at which corona first appears can be raised appreciably by judicious designs in this direction. (7) The radius of curvature of the head of the porcelain cap

in the cap and pin type insulator should be as large as possible.—*Sibley Journal of Engineering*, January, 1918.

Traction

Electric Tractors in Municipal Service.—A description of various types of tractors adopted for municipal service by the city of Wiesbaden, Germany, on account of the scarcity of horses. The machines still need perfecting, especially as regards the extinction of the arcs. For light vehicles with small batteries forty elements (80 volts) are enough. Two motors rated at 5 hp. are satisfactory for most vehicles, four motors being desirable for the heaviest ones. These motors should withstand an overload of 50 per cent for long periods. Motors of high speed and double reduction are recommended.—*Revue Générale de l'Electricité*, Jan. 5, 1918 (abstracted from *Zeits.* V. D. I., April 28, 1917).

Installations, Systems and Appliances

Calculation of Energy Absorbed by Starting Rheostats.—J. SAINT-GERMAIN.—In this article a graphical method is described by which, in every case, one may calculate the energy absorbed in rheostats used to start direct-current and induction motors in terms of acceleration and resistance and of the duration of the starting period. Algebraic formulas are given which permit the same result to be obtained more rapidly.—*Revue Générale de l'Electricité*, Jan. 5, 1918.

Electrical Mining Machines.—F. ROBIN.—An extended technical article on electricity as employed in the extraction of coal and iron. The author seeks to reduce to the minimum the I^2R losses in the armature of the motor and the generator used for this service by properly proportioning the periods of acceleration of operation and of slowing down.—*Revue Générale de l'Electricité*, Jan. 5, 1918.

Electric Cargo Winches.—E. F. WHITNEY.—The use of electricity on shipboard is increasing rapidly in both the variety and the extent of its applications. Most ships to-day are electrically lighted, have their fans, pumps, etc., electrically driven, and are equipped with a radio outfit. In addition to these applications, the galleys of many ships are electrically equipped, and a considerable number of ships are electrically propelled. A comparatively recent but equally successful development is the application of electric drive to cargo winches. The magnitude and characteristics of winch work are defined, the electrical equipment is described, and the superiority of its operation over steam-winch operation is discussed in terms of reliability, speed control, cost and efficiency.—*General Electric Review*, February, 1918.

Wires, Wiring and Conduits

Cable Fault Localization in Practice.—D. M. W. HUTCHISON.—The writer gives some actual results from his own experience in the locating of faults in underground cables. Loop tests, with the dial resistance boxes supplied in so-called "mains testing sets," and "search-coil tests," were found to be very inaccurate and were abandoned. The writer points out that for the difference of potential tests a 4-volt storage battery, a bank of lamps, a reversing switch, an arc-lamp resistance and a galvanometer like that used in loop tests were all the apparatus required. On the occurrence of a fault the procedure was as follows: All service fuses were removed, both ends cleared, and a megger test and lamp tests were made. The faults were then classified as follows: (1) All cores shorted and earthed; (2) all cores shorted but not earthed; (3) two cores shorted, third good, no earth; (4) two cores shorted and earthed, third good; (5) one core earthed, others good, and (6) total disconnection. The author explains in four examples the calculations necessary. Example 1 is a loop test, class 3 fault, three-core V.B. cable-megger tests. Example 2 is a loop test, class 3 fault. This has been given because it is a good example of how the megger tests may be misleading if not supplemented by lamp tests. Example 3 is a difference of potential test, method 1, class 4 fault. Example 4 is a difference of potential test, method 2. This is an example of the method which was used for faults of classes 1 and 2.—London *Electrical Review*, Jan. 18, 1918.

Electrophysics and Magnetism

Graphical Representation of Resistances and Reactances in Multiple.—H. C. STANLEY.—Frequently a number of resistances or reactances are connected in multiple and it is desired to know their total or combined value of resistance or reactance. The calculation necessary to obtain this combined value is usually simple in principle but at times laborious in practice. For approximate results and as a check on the more accurate calculations a graphical solution is given in this article for some representative cases.—*General Electric Review*, February, 1918.

Units, Measurements and Instruments

Electromagnetic-Clutch Indicating Device.—V. KARAPETOFF.—This is a device for predicting the performance of the Entz electromagnetic clutch and transmission used on motor cars propelled by internal-combustion engines. This device is one of the several kinematic models, partly built and partly designed by the author, for the general purpose of quantitatively imitating the performance of various types of direct-current and alternating-current machinery. He hopes to bring them to a degree of convenience and perfection such as to do away with tedious analytical computations, or complicated graphical diagrams used in the design and predetermination of performance of electrical machinery. It is pointed out that the designer will simply have to select provisionally the constants of his proposed machine and to set certain types of a kinematic device to correspond to these constants. Then by moving certain levers he can obtain and read to scale various performance characteristics of the proposed machine, such as speed, power factor, output, etc. If the performance is not satisfactory, he can easily change the setting of constants and after a few trials get the desired characteristics.—*Sibley Journal of Engineering*, January, 1918.

Telegraphy, Telephony and Signals

Electrical Signaling and Control on Railways.—C. M. JACOBS.—A comparison of British and American signaling with details of control.—London *Electrical Review*, Jan. 18, 1918.

Reis Telephone and Nature of Sound.—ARTHUR BESSEY SMITH.—This is a discussion of the "break-and-make" theory of the Reis telephone in regard to its relation to nature of sound. The structure of the Reis telephone, its intended action and its occasional action are discussed. It is pointed out that this is not a practical instrument.—*Telephony*, Jan. 26, 1918.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

FEATURES OF BRITISH PRACTICE IN RESEARCH

Taken from Report of British Committee for Scientific and Industrial Research as Suggestions for Formulating American Practice

Some points are brought out in the report of the British Privy Council committee for scientific and industrial research which might be utilized in organizing research in this country. The report covers features of organization, administration and policies of the committee.

Funds Available.—The Imperial Trust for the Encouragement of Scientific and Industrial Research holds £1,000,000 that Parliament has voted for research purposes. Manufacturers' associations, the London County Council and some governmental departments have also contributed funds for specific purposes.

Personal Grants to Research Workers.—Thirty-six awards in the nature of maintenance grants were made to individuals, of which twenty-four went to students being trained in the methods of research, ten to independent research workers and two to research assistants. Grants will also be made for apparatus and materials.

Industrial Versus Pure Science Research.—During the past year the committee has devoted its chief effort to the organization of industrial research rather than to the prosecution of work in pure science; first, because it felt the paramount importance of arousing the interest of manufacturers and, second, because of the influence of the war. It emphasizes the hope that the absence of references to pure science should not be taken as indicating a lack of appreciation of its importance.

Trade Research Associations.—Many trade associations have lately come into existence, some of which include research among their objects. The committee has helped in their organization and has assisted and co-operated in their research activities.

Research in the Universities.—Hearty co-operation of the principal universities, technical schools and trade schools in England has been secured, and their resources have been co-ordinated for the important problems on hand. A closer connection is being established between these institutions and the industries which rely upon results of research in the manufacture of their products.

Technical Societies.—The committee is co-operating with the electrical, mechanical and mining engineers' institutions and other professional societies, in some cases subsidizing the researches originated by the institutions and extending their scope.

Information Collected and Published.—In co-operation with technical societies and institutions of learning the committee has collected and published available information and is continuing this useful work, which will greatly simplify that of future investigators. It is also preparing memoranda on various fields for research, with an analysis of the problems involved and the proposed program for research.

Assistance to Individual Manufacturers.—An arrangement has been made with the Royal Society by which it will assist the committee in selecting the institution or research workers best fitted for a particular investigation. If the investigation progresses satisfactorily, the manufacturer is invited to contribute part or all of the expense in exchange for the exclusive use of the results over a given period. Another proposed way is to attach an investigator to the works laboratory and share expense with the manufacturer.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE JAN. 19)*

GASES, COMBUSTIBLE, IN THE AIR.
Development of an electrical method of measuring the amount of combustible gases in the air.—*E. R. Weaver and E. Weible, Bureau of Standards, Washington.*

HEAT TRANSMISSION.
Rate of heat transmission from the surfaces of hot bodies to fluids passing over them. The primary object is a reduction in the weight of gasoline engines for aircraft by a more efficient design of the cooling surfaces, but the data obtained will also have other important industrial applications.—*National Physical Laboratory, England.*

RESONANCE IN ALTERNATING-CURRENT CIRCUIT.
A suitable combination of series and parallel circuits makes it possible to secure two maximum values of the current, while the voltage is kept constant and the frequency is being varied. A considerable control can be exerted on the nature of the variation of the total impedance and power factor with change of frequency. If the total impedance is plotted as a vector in a polar diagram, the hodograph can be made to assume the form of a strophoid with the loop embracing the current axis. In such a case the current hodograph has the form of a limacon and the power factor passes through unity at three different frequencies and can be made to hover near unity over a large range. The considerations involved are of interest in connection with non-harmonic currents in complex circuits.—*H. K. Dodge, University of Iowa.*

SYNCHRONOUS MACHINES, SHORT CIRCUIT.
(1) Flux distribution in alternators with salient and non-salient poles, under sustained short-circuit conditions. (2) Calculation of phenomena accompanying sudden short circuits in such alternators. (3) Experimental and theoretical study of electro-mechanical phenomena occurring under sudden short-circuit conditions.—*N. S. Diamant, Rice Institute.*

APPARATUS AVAILABLE FOR RESEARCH

SALT LAKE CITY, UTAH.
An artificial transmission line is available which on a small scale duplicates in considerable detail the actual transmission system of the old Telluride Power Company. The artificial line consists of inductance coils, plate condensers and wires of high resistivity, which represent to a certain scale the inductance (self and mutual), the capacity and the resistance of the actual line. The transformers, the load and the generators are also imitated, so that the performance of the actual line may be studied under many normal or abnormal conditions. An oscillograph and other measuring instruments are available. Some tests have been made on this artificial line to elucidate the action of reverse-power relays under various short-circuit conditions. (See A. I. E. E. *Proceedings*, Vol. 36 (1917), p. 713, where a detailed description of the line will also be found.)—*M. Cheever, Chief Engineer Utah Power & Light Company.*

SUGGESTIONS FOR RESEARCH

INSULATION, THERMAL CONDUCTIVITY.
Investigation of the thermal coefficient of the insulating medium in which copper coils are embedded in electrical machinery.—*B. A. Behrend, Boston, Mass.*

PHASE BALANCING.
Investigation, theoretically and experimentally, of the extent of balancing possible with polyphase induction motor connected across polyphase circuit and also the motor constants that are conducive to most accurate balancing. Would a synchronous motor accomplish the same purpose with the additional advantage of phase correction?—*Editorial suggestion.*

VENTILATION OF ELECTRICAL MACHINERY.
The flow of air and its convective capacity at different velocities and at different temperatures; the effect of eddy currents and vortex motion in such air currents on their convective capacity; obstacles to the motion of air and the creation of eddies at edges due to discontinuous motion.—*B. A. Behrend, Boston.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

INTERCONNECTION SAVES POWER AT SCHENECTADY

Co-operation of Five Utility Companies and One Manufacturing Company Relieves Critical Power Situation on Short Notice

Under normal conditions the Schenectady Illuminating Company and the Schenectady Railway Company receive all of their power from the General Electric Company, which generates part by steam and receives part from the Schenectady Power Company. The latter company has a hydraulic station at Schaghticoke. Owing to the abnormal winter the water supply at the Schaghticoke plant is practically frozen up. After carrying for some weeks this burden on the steam plant of the General Electric Company, combined with the enormous load brought on by the large amount of government work which has been done in Schenectady, it became imperative at once to relieve the steam plant of the General Electric Company of from 2000 kw. to 4000 kw. during the day.

In the emergency General Manager Henry W. Peck of the Schenectady Illuminating Company immediately got in touch with Carl H. Graf, Municipal Gas Company of Albany; W. A. Buttrick, Adirondack Electric Power Corporation; E. B. Doen, Schenectady Power Company, and A. L. Rohrer, General Electric Company. Within twenty-eight hours of the time that Mr. Peck was notified of the urgent need he was receiving, with the most hearty co-operation of the officials mentioned, the necessary supply in Schenectady.

This supply was transmitted to Schenectady indirectly. The Adirondack Electric Power Corporation, with hydraulic plants at Spier Falls and Mechanicville, normally supplies electric energy to Albany, as well as to Troy, Glens Falls and other places. The shortage of water had already required the supplementary operation of the 15,000-kw. steam-turbine plant of the Municipal Gas Company. Upon receipt of the request from Schenectady this station assumed more of the Albany load to the approximate amount required by Schenectady, thus relieving the Adirondack company of that load.

The Adirondack company, in turn, having an open-air switching connection with the high-tension line of the Schenectady Power Company near Mechanicville, made connections and supplied the needed power from its line over one of the lines of the Schenectady Power Company to a section of the busbars in the power house of the General Electric Company, whence it was conveyed on the lines of the Schenectady Illuminating Company and Schenectady Railway Company to their substation.

This co-operation of five utility companies and one manufacturing company is noteworthy, and undoubtedly its successful accomplishment is an indication of the advantages that accrue through a consolidated power system.

SIDELIGHTS ON THE EVENTS AT WASHINGTON

Criticism from Congress, Which Demands Action and Does Not Act Itself—The Bills Which Are Not Passed

(By Our Washington Correspondent)

This is the day of criticism. It has been inspired in Congress—to what extent at the behest of the people back home remains to be seen. On every side one hears that Congress is demanding action, reorganization and co-ordination. What is Congress doing to keep the war machine moving, besides blowing the hot breath of criticism? In two precious months, while American lifeblood is taken in the trenches and on the high seas, while business is straining behind the lines, Congress has not placed on the legislative books one single big constructive act.

* * *

Money is needed. Authorization is needed to spend money, to plan, prepare, act, co-ordinate. As this is written the House of Representatives has passed but three of the big money-supply bills—post office, Indian and agricultural—and those, in the large sense, are not war money bills. By the time this is printed the legislative, executive and judicial appropriation bills may be passed by the House. The Senate has not passed any of the appropriation bills. The only measures of consequence passed by the Senate so far are the coal and oil lands leasing bill and the Shields water-power bill. These have not been passed by the House. In other words, literally nothing has been done. Industries need the apparently unobtainable passage of the conference report on the Webb bill, which would permit combination for export trade, as well as a real law permitting water-power development.

* * *

Secretary Baker is to go to France for an indefinite period, to take his seat on the Supreme War Council. In his place the President must find another man who, under the President's proposed legislation, will fill the post which Senators have been trying to create—Ministry of Munitions, or its equivalent. Is not this the place for Mr. Stettinius, and is it not time to bring forward business men of his type?

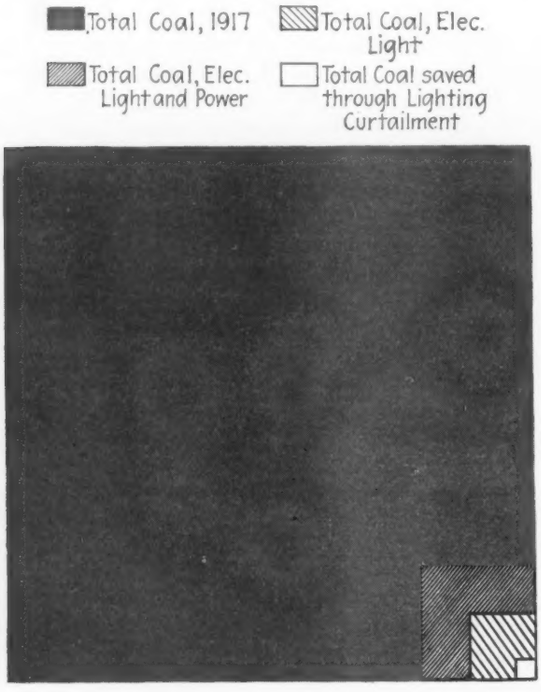
* * *

There has been too much let-up in many fields already. Highways must be maintained and developed as a war measure. With the failure of steam transportation, truck lines are coming more into use. There must be money for more power plants. It is not at all certain that the power-from-coal question will be solved by good weather and restoration of steam-traffic facilities. More power plants, or expansion of present power plants, is indicated. Capital must be obtained and a properly founded and administered "War Finance Corporation" could be of the greatest service.

CURTAILMENT OF LIGHTING MEANS SMALL COAL SAVING

Preston S. Millar, in Paper Before Illuminating Engineering Society, Says Other Methods Will Save More Fuel

In a paper on "Lighting Curtailment," presented before a special meeting of the Illuminating Engineering Society, New York, on Feb. 14 and at a meeting of the Philadelphia Section on Feb. 15, Preston S. Millar, general manager Electrical Testing Laboratories, New York, said that the amount of coal used in the production of electric light is less than 2 per cent of the total coal output of the country. Curtailment, therefore, can accomplish relatively little in saving coal.



Mr. Millar made prominent in the discussion his belief that in general the standards of illumination intensity before the war were too low. In view of the war and fuel shortage, he believes that lighting ought to be reduced in some classes of service and increased in others. Any practicable curtailment is about 7 per cent net for all classes of lighting service, or a trifle more than one-tenth of 1 per cent. Declaring that it is practicable to effect much larger fuel savings by other methods with less disadvantage to the public, Mr. Millar called attention to a number of points, including the elimination of small power plants, with their "inherently lower efficiency," estimated to be "responsible for the use of one-third more coal than necessary."

"The most important thing is to win the war," said Mr. Millar in beginning.

Cost of artificial illumination, one-half of 1 to 2 per cent of the total expenditure of the people, compares with other expenditures as follows: Illumination, $500,000,000; liquors, $665,000,000; tobacco, $490,000,000.

The significant figures to have in mind when discussing this subject, said Mr. Millar, are as follows, all being rough approximations: Total coal output of the country, 640,000,000 tons; total employed in production of electric light and power (traction excluded), 36,000,000 tons; total employed for production of light by electricity, 12,000,000 tons.

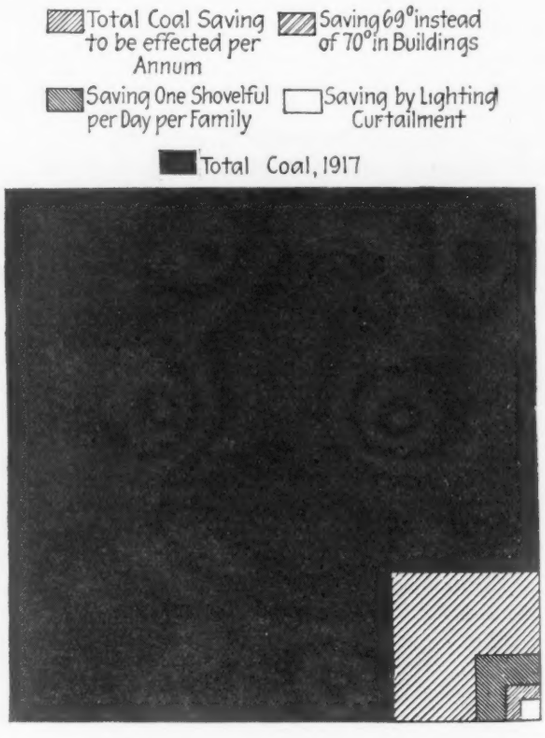
According to these estimates, about 2 per cent of the coal consumption of the country goes into electric light. Some comparisons may assist to provide a proper perspective for the consideration of these data: The coal

RECOMMENDED ADJUSTMENT OF ILLUMINATION INTENSITIES IN VIEW OF THE WAR AND THE FUEL SHORTAGE

Class of Lighting Service	Per Cent Distribution	Desirable Adjustments in Intensity, Per Cent
Street	15	— 5
Public building	3	— 10
Industrial	18	+ 50
Protective	1	+200
Commercial	20	— 20
Residence	26	— 20
Recreational	7	— 40
Advertising	5	— 80
Miscellaneous	5	— 10
Total	100	Net — 7

shortage, the equivalent of which must be saved, is 50,000,000 tons; the estimated saving in coal during 1914 if all private plant power could have been replaced by central station power, 13,000,000 tons, and the estimated saving in coal by maintaining temperature of building interiors at 67 deg. Fahr. instead of 70 deg. Fahr. comes to 10,000,000 tons.

It is evident therefore that the total consumption of coal in the production of all electric light is relatively


Total Coal Saving to be effected per Annum
Saving 69° instead of 70° in Buildings
Saving One Shovelful per Day per Family
Saving by Lighting Curtailment
Total Coal, 1917

not a very large item in the coal consumption of the country. If the entire electric lighting of the country were cut off, the saving in coal would be only 24 per cent of the required saving and no more than would be accomplished by a reduction of readily practicable extent in the heating of buildings.

The author has prepared the table in this column, which roughly estimates how artificial light is dis

tributed among the several classes of service adopted as a classification for this purpose.

Beside these figures showing approximate distribution of lighting among the several classes of service are figures representing the consensus of opinion of ten qualified observers as to the extent to which lighting in each class of service ought to be curtailed or increased in the present emergency. The values are thought to be reasonably indicative of expert opinion on this subject at the present time.

One may ask, says Mr. Millar, why this net saving should be adopted as the conclusion from this survey instead of 17½ per cent, which is the gross saving from which no deduction is made to cover the desirable increases. The author says that he would consider himself unworthy to discuss this important subject before the Illuminating Engineering Society if he failed to insist that except in the presence of an actual coal shortage which could not be compensated by saving elsewhere, the increases in intensities which are recommended for certain classes of service are more important to the public welfare than is the coal saving which it is desirable to effect in other classes of lighting service. The net saving therefore is the value which should enter into our calculations.

In his conclusions Mr. Millar says:

After careful consideration of this subject, including study of the statistics presented in this paper, the author has reached the personal conclusion that to curtail lighing generally would result in damaging the eyesight and impairing the efficiency of our people. He believes that the country cannot afford to incur such a risk for the sake of the small coal saving which may result—a saving which may be accomplished otherwise with much less disadvantage.

UTILITIES MUST CONSERVE THEIR FINANCIAL STRENGTH

California Railroad Commission, in Case Affecting Pacific Gas & Electric Company, Favors Expenditures to Win the War

The California Railroad Commission, in a decision permitting the Pacific Gas & Electric Company to use $771,348, proceeds of the sale of bonds for capital expenditures in the recent past, passes for the first time on the vital question of public utility financing in the war emergency.

A proposed issue of $3,000,000 bonds is considered unwise now on account of the money market, and the company has so stated. The commission says:

It is a matter of common knowledge that many public utilities as well as other enterprises will have considerable difficulty in financing new construction during the war. The general welfare requires that our electric utilities, which play so vital a part in the nation's efficiency, shall in so far as possible conserve their financial strength so that they may continue to be able to secure such funds as are imperatively needed to increase their production and maintain their efficiency.

Expenditures which otherwise might be considered desirable, even though not immediately necessary, should be deferred in favor of expenditures most urgently necessary at the moment to increase the efficiency of these utilities to help win the war. Furthermore, while the cost of materials and money is abnormally high, it is in the interest of both the utility and its patrons that all work not clearly now necessary be deferred. This situation requires an analysis of proposed large expenditures from a different point of view from what was the case before the war.

PROBLEMS OF UTILITIES PRESENTED AT WASHINGTON

Prominent Executives of Companies Appear Before Capital Issues Advisory Committee of Federal Reserve Board and Senate Committee

Representatives of the public utility companies have had two opportunities in Washington within the last few days to present their problems to government legislators and officials and are much encouraged with the reception of their views.

On Feb. 8 these problems were presented before the capital issues advisory committee of the Federal Reserve Board, with Governor Delano and Governor Hamlin present and Allen B. Forbes, chairman, presiding. On Feb. 12 representatives of the utility companies appeared before the Senate committe on finance to discuss the proposed "War Finance Corporation" bill.

The argument before the capital issues advisory committee was presented by P. H. Gadsden, member of the war board of the American Electric Railway Association, at the request of John Stanley, president of the association. Mr. Forbes, chairman of the advisory committee, had requested heads of large utility organizations to be present, and in addition to Mr. Gadsden among those present were the following:

John W. Lieb, New York Edison Company, president National Electric Light Association; Alfred Forestall, president American Gas Institute; E. K. Hall, Electric Bond & Share Company, New York; H. H. Crowell, Commonwealth Power, Railway & Light Company, New York; C. M. Clark of E. W. Clark & Company, Philadelphia, and H. G. Bradlee, Stone & Webster, Boston.

At the hearing before the Senate finance committee statements were made by S. R. Bertron of Bertron, Griscom & Company, New York; Mr. Crowell and Mr. Gadsden. The argument, which was substantially the same at both hearings, was in effect as follows:

First—Public utility rates must be increased. Labor and materials are eating up equities in those properties. The fundamental remedy is to restore values by increase in rates.

Second—During the war the companies should be relieved of franchise requirements, such as paving streets and putting wires underground, regarded as unnecessary capital investment at this time.

Third—Companies are being called upon to make large expenditures for extensions and betterments to meet the war program. It is estimated that these expenditures for the year will be between $100,000,000 and $200,000,000 required for government purposes. Some way must be provided for the government to furnish this money.

Fourth—The public utilities—railway, gas and electric companies—have maturing obligations in 1918 of about $225,000,000. Under present conditions, where the government has monopolized the whole money market, it is impossible to finance these maturities through the banks, and if the companies are to continue to perform their essential part in furnishing facilities for speeding up industry in this country the government must furnish utilities some relief in taking care of the maturing obligations.

It is understood that the Senate committee on finance was evidently impressed seriously by the situation which confronts the companies. On the question of rates members of the committee frankly asked the gentlemen before them if it is not possible for Congress to grant some relief. It is felt that the committee practically unanimously saw the force of the rate question, as well as sympathized with the suggestion

that the companies be relieved from non-essential expenditures; also there was apparently no question that the committee realizes that much new capital will be required by the companies in order to meet government war needs.

The committee by its questions indicated an apparent unwillingness to grant such unlimited powers as those conferred in Section D of the proposed "War Finance Corporation" bill.

Mr. Gadsden took the position before the committee that public utility securities are a class which must be taken care of and suggested to the committee that the words "public utilities" be inserted in this section of the bill to leave no doubt that it was the intention to provide for them.

A hearing at which representatives of public utilities will be present will be held soon on this bill before the House committee on ways and means.

RELATION OF THE WAR TO JOBBERS' BUSINESS

Atlantic Division of Electrical Supply Jobbers' Association, Meeting at Philadelphia, Discusses Timely Problems—E. C. Graham Chairman

War in its economic relation to business was the keynote of the Philadelphia meeting of the Atlantic division of the Electrical Supply Jobbers' Association held on Wednesday of the present week at the Bellevue-Stratford Hotel.

The session opened in the morning with the presentation by M. A. Curran, general credit manager Western Electric Company, of a plan for the practical application of trade acceptances in a comprehensive manner. Mr. Curran emphasized the fact that there must be an intelligent introduction of trade acceptances if they are to prove to be of value in the long run.

Touching briefly on the opportunities for profitably increasing the business of electrical jobbers, J. M. Wakeman, general manager Society for Electrical Development dwelt largely on the growing strength of the electrical appliance market. He expressed the thought that wider distribution of electric ranges would leave its impression on the nation's domestic coal supply through more economical and efficient utilization of fuel.

Considerable enthusiasm arose over the paper entitled "What the War Means to American Business," read by G. E. MacIlwain, specialist of the Babson statistical organization. Mr. MacIlwain pointed to the industrial leveling of Europe and what it means to American business. Through the industrial awakening of Europe the United States will face after the war a more efficient competition. The author showed a four-period condition: First, good business during the war, limited by priorities and curtailment of great private profits; second, a temporary lull to accompany real peace proceedings; third, a short, sharp peace boom at the immediate end of the war, and, fourth, a very marked decline and depression to follow. In closing, the speaker drew attention to the changing relation of labor to capital, predicting that the solution of the labor problem will come about through participation with capital in profits.

C. E. Patterson, comptroller, and J. F. Zoller, tax attorney for the General Electric Company, went somewhat into detail on the accounting and legal aspects generally of the preparation of returns under the war tax law. The members of the division were urged to secure copies of regulation No. 41 relative to the war excess profits tax issued by the Treasury Department and corporation tax form No. 1031. Excess profits tax form No. 1103 is not yet ready for distribution.

At the close of the session officers for the ensuing year were elected. E. C. Graham, Washington, was elected chairman.

WORKLESS MONDAY ORDER SUSPENDED BY GARFIELD

State Fuel Administrators, However, Still Have Authority to Enforce Restrictions and Reservations—Embargoes Hold

Dr. Garfield announced on Feb. 13 that the order for heatless and workless Mondays until March 25 had been suspended. However, state fuel administrators will retain the full authority heretofore conferred upon them to establish and enforce such restrictions and regulations as may be made necessary by coal conditions in their respective communities.

The Fuel Administrator said: "Conditions to-day warrant the conclusion that with the continued enforcement of the preferential delivery of coal under Section 1 of the order of Jan. 17, and continued transportation improvement, further restrictions on the consumption of fuel will not be necessary."

Director General of Railroads McAdoo concurred in the suspension of the order, but warned that it should not be assumed that there is no further need for economy in coal.

MOBILIZATION PLAN FOR THE EDUCATIONAL INSTITUTIONS

Committee on Education and Special Training Is Created in the War Department with Advisory Civilian Committee

With a view to mobilizing educational institutions and their facilities for special training there has been created in the War Department a committee on education and special training. Associated with this committee will be five civilian educators, known as an advisory board of educators.

The committee will be composed of Col. Hugh S. Johnson, deputy provost marshal general; Lieut. Col. Robert I. Rees of the General Staff, and Major Grenville Clark of the Adjutant General's department.

The five advisory members of the committee, whose selection has been approved by Secretary of War Baker, are: Dr. Charles R. Mann of the Carnegie Foundation for the Advancement of Teaching and the Massachusetts Institute of Technology; Dr. James R. Angell of Chicago, dean of the faculties of the University of Chicago; J. W. Dietz of Chicago, director of education Western Electric Company, president National Association of Corporation Schools; James P. Munroe of Boston, member of the Federal Board for Vocational Education (which appointment will include the interests of the trade schools and schools of secondary grade), and Dr. Samuel P. Capen of Washington, specialist in higher education.

PORTABLE ELECTRIC TOOL MANUFACTURERS ORGANIZE

Majority of Firms in Field Are Charter Members—Standardization Planned—Walter Friedlander of Cincinnati Elected President

Manufacturers of portable electric tools organized the "Portable Electric Tool Association" at Indianapolis on Jan. 11 and 12. Already the new organization has fourteen members, leaving as prospective members only about six more important firms, most of which have expressed interest and will probably become members before the next meeting.

The constitution and by-laws of the association follow closely those of the Electric Power Club. There is no conflict between aims and purposes of the new association and the Electric Power Club, it is said, as the Portable Electric Tool Association will confine itself to tool problems. Briefly stated, the aims and purposes of the association are: First, discussion of subjects of interest and value to members; second, advancement and improvement of the portable-tool industry; third, collection and dissemination of statistics, and, fourth, standardization of design, manufacture and application of portable electric tools.

In the past this branch of the tool business has suffered greatly from those ills likely to be found in any young and actively competitive industry. When business was not flourishing, some manufacturers would get out a freak portable electric tool and by clever salesmanship would probably sell a few hundred. Frequent repetition of this process by many manufacturers has created a condition wherein there are many times the number of styles and sizes of portable electric tools needed to do any kind of work. Government departments sometimes contributed to this condition by requiring special tools built on bureau specifications, when a standard tool would have done as well.

The association, it is expected, will correct this, its standardization committee working with the government to establish proper and adequate standards. Portable electric drills, which will probably come first in the standardization program, will, it is likely, be reduced to ten standard sizes between 3/16 in. and 2 in. (0.47 cm. and 5.08 cm.). The motors required by the machines will, of course, be of sizes less than 2 hp. or possibly 3 hp.

Other evils which the association may attempt to correct later are the much-overworked free trial and free-repair "bugaboos." The goods of each association member are guaranteed, so it is argued that ten days' free trial with frequent extensions should not be necessary. Likewise it is believed that a just method can be found for dealing with the unfair customer who purchases a few tools from each manufacturer, then systematically reviles each set of tools to its manufacturer for the sole purpose of securing concessions in the way of free-repair parts.

The officers of the Portable Electric Tool Association are: President, Walter Friedlander, Hisey-Wolf Machine Company, Cincinnati; vice-president, F. Schneider, Van Dorn Electric Tool Company, Cleveland; treasurer, James Clark, Jr., James Clark, Jr., Electric Company, Louisville; secretary, R. S. Cooper, Independent Pneumatic Tool Company, 1307 South Michigan Avenue, Chicago.

LOCAL COMMITTEES ON CAPITAL ISSUES

Committee of the Federal Reserve Board Announces Formation of Local Bodies to Assist in Passing on Applications

The capital issues committee of the Federal Reserve Board announces the formation of twelve local committees organized for the purpose of assisting the central committee in passing upon applications originating in their respective districts.

In each Federal Reserve district there will be a sub-committee on capital issues, with headquarters at the Federal Reserve bank of the district. The sub-committee will consist of the Federal Reserve agent as chairman, the governor of the Federal Reserve bank as vice-chairman, and three other members chosen because of special qualifications for the work.

Bankers and others having broad experience in the financing of municipal, manufacturing or public utilities securities have been invited to become affiliated with the sub-committee as an auxiliary body, one or more members of which from time to time, as their advice and experience may be useful or helpful, will be asked to join with the sub-committee in investigating and passing upon specific applications. No committee member will give advice or report upon any application in which he has a direct or indirect personal interest. Members of these committees have undertaken this duty as a patriotic service to the country.

All applications for the approval of security issues are expected to be made direct to the capital issues committee, Federal Reserve Board, Washington, which will refer them to the particular district concerned.

Among the members of the local permanent or the auxiliary committees are a number familiar with utility problems.

NEW YORK CITY JOBBERS ELECT OFFICERS FOR YEAR

New Constitution and Bylaws Also Adopted by the Electric Club—J. E. McClernon the President

At the second annual meeting of the New York Electric Club, held on Feb. 6, officers were elected and plans discussed for the coming year's work. The membership comprises practically all electric jobbers of New York City. A new constitution and bylaws were adopted. The purpose of the club is stated as follows:

The object of the club shall be the advancement of the social, professional and commercial interests of the members, the elevation of the standard of electrical work, a furtherance of the use of electricity and the general development of the electrical industry.

A paid secretary-treasurer, W. J. Krieger, Marbridge Building, New York, has been employed to centralize and promote the work. Officers for 1918 were elected as follows: President, J. E. McClernon, Northwestern Electrical Supply Company; vice-president, Charles E. Benz, Holloway & Benz Company; executive committee: J. J. Hartt, Hartt & Morrison; G. P. La Shelle, W. R. Ostrander Company; J. H. Hughes, Alpha Electric Company; J. H. Owen, E. B. Latham Company; M. Zucker, A. Shemel & Company, and L. D. Bailey, Bailey Electric Supply Company.

INCREASING ECONOMY OF POWER IN CALIFORNIA

Southern Group of Systems Now Under One Power Dispatcher—All Feasible Tie-ins Are Considered—Water Shortage Will Be Serious

At a hearing before the California Railroad Commission on Jan. 31 there was further detailed discussion of the interconnection of transmission lines and conservation of fuel oil. A detailed statement was presented by companies in the northern and southern divisions into which the State has been divided. The report of an earlier hearing appeared in the ELECTRICAL WORLD for Jan. 26, page 218.

A supplement to the report of the northern division, presented by John A. Britton, Pacific Gas & Electric Company, pointed out that northern California hydroelectric power companies are facing one of the most alarming situations in their history. "Not only are we faced with the necessity of generating about 30,000 additional horsepower to take care of the normal increase in amount of power needed each year," said the report, "but the lack of rain and snow may make it impossible to maintain the present output." Priority orders on a 15,000-kw. steam turbine unit now being built for the Pacific Gas & Electric Company have been secured. It is understood that this action has not only been approved by the Fuel Administration, but sufficient fuel oil to operate the unit has been guaranteed.

The report of the northern division, presented by J. E. Woodbridge, stated in detail where power could be exchanged to advantage from system to system, what new projects could probably be developed at once, and where additional interconnections were needed. The several methods of effecting greater economy which the committee recommended are expected to afford a combined saving on all systems in the northern division of 1,758,000 bbl. of oil per year.

The most important interconnection recommended is that which would tie in the Northern California Power Company system with the Pacific Gas & Electric lines at Colusa. This would add to the central group about 12,000 kw. at 80 per cent load factor. To accomplish this, however, an exchange of energy between the California-Oregon Power Company and the Northern California Power Company is necessary and an investment of about $980,000 in an interconnecting line.

The committee from the northern division specially urged upon the Railroad Commission "the necessity for some affirmative action which will tend to the further development of possible hydroelectric plants in California, both along the lines of financial encouragement to the companies and affirmative aid in Congressional legislation regarding the occupancy of public lands such as would be calculated to make hydroelectric developments attractive to those who must finance the development."

The report from the southern division stated that the Southern Sierras Power Company and Southern California Edison Company systems had been put under a single power dispatcher so far as exchange of energy is concerned. In its previous report the southern division committee reported that 1917 fuel consumption, amounting to 1,056,000 bbl. of oil, could be reduced in 1918 to 600,000 bbl. The report of Jan. 31, however, states that more recently means have been found for reducing 1918 consumption to 275,000 bbl.

These additional economies have been worked out after running tests on steam-plant efficiency in order to determine where fuel oil can be used to best advantage, by comparing power transmission systems and load curves to find where and when energy can be exchanged advantageously, and by increasing the load on plants where additional capacity is available.

PROGRESS TOWARD TYING IN THE CALIFORNIA SYSTEMS

Results of Inquiry Into Possibilities of War Conservation and Economy by Co-operation in Southern California

Negotiations between California electric generating systems and the California Railroad Commission looking to the combination of transmission lines and other means of co-operation to save fuel were reported in the ELECTRICAL WORLD for Jan. 26, 1918, page 218. Reference was made in that article to the report submitted by R. H. Ballard, general manager Southern California Edison Company, for the committee which has been studying conditions in the southern part of the State.

The inquiry into the possibilities of war conservation and economy by co-operation in the use of resources and facilities by power companies of the southern San Joaquin Valley and southern California covered the following properties: Southern California Edison Company, Los Angeles Gas & Electric Company, Los Angeles Aqueduct, San Joaquin Light & Power Corporation, Mount Whitney Power & Electric Company, Southern Sierras Power Company and San Diego Gas & Electric Company.

For the purposes under consideration, the Santa Barbara Gas & Electric Company and the Ventura County Power Company were considered part of the Edison system.

The accompanying table shows the amounts of power generated by steam in 1917 and which must be generated by steam in 1918 to 1921 inclusive, and the amount of natural gas and fuel oil that must be burned to generate the required steam power in the event that no additional hydroelectric developments are completed during the period. The amounts of natural gas listed are those used by the Edison company and Los Angeles Gas & Electric Company, and include amounts which the San Joaquin company is now preparing to utilize. The table is based on average water conditions. A low-water year would increase the steam power necessary.

	Millions of Kilowatt-hours				Fuel Necessary	
Year	Total	Available Water Power	Balance by Steam	Per Cent Steam	Millions of Feet of Gas Available	Bbls. Oil for Balance
1917	1,146	911	235	21.5	1,400	1,056,000
1918	1,270	1,087	183	14.4	1,800	600,000
1919	1,410	1,110	300	21.3	2,100	1,150,000
1920	1,565	1,110	485	29.1	2,100	1,925,000
1921	1,715	1,110	605	35.3	2,100	2,675,000

The table shows a notable reduction in steam power for 1918 under 1917. The causes of this reduction as stated in the report are:

The Edison company has completed an increase in its Huntington Lake reservoir which will enable it to store an additional 35,000 acre-feet.

Arrangements were made some time ago for interconnection between the Edison and Southern Sierras companies,

the San Diego and Santa Barbara companies. A 5000-kw. frequency changer has been installed for interchange of power between the Edison and Southern Sierras. A line is being constructed to supply all the requirements of Santa Barbara Gas & Electric and is now carrying part of the load of that company; the balance will be carried as soon as the construction work can be completed. Substation apparatus has been purchased and lines are now in process of construction for the installation of two 5000-kw. frequency changers at Capistrano for interconnection between Edison company and San Diego company. By the foregoing means all the companies mentioned will be able to share in the benefits of diversity of load and power resources.

The Edison company has arranged to transmit a small amount of natural gas to its Redondo plant.

The San Joaquin company has purchased and is preparing to lay a pipe line to its Bakersfield steam plant, which will enable it to utilize 600,000,000 ft. of gas per year, one-half of which will be available in 1918 and the whole amount in 1919.

Increases in load will enable Southern Sierras to utilize about 9,000,000 kw.-hr. and San Joaquin 26,000,000 more kw.-hr. from the available water during the run-off season.

During 1918 it will be possible for the companies to make some additional arrangements for utilizing flood-water kilowatt-hours.

	Kw.-hr. per Year	Equivalent Barrels of Oil
1. The city of Los Angeles has some small plants in Owens River valley which can be connected to the Southern Sierras system, furnishing	10,000,000	50,000
2. Some of the San Joaquin surplus can be used by Mount Whitney	7,000,000	35,000
3. Arrangements can possibly be made for Edison company to use any surplus power San Joaquin may be able to generate from gas at its Bakersfield plant, equal to	30,000,000	150,000
4. It is possible that the Edison company can do some of the regulating for Southern Sierras, which will not amount to any large quantity of kilowatt-hours, but will save standby oil. No value can be put on this until it is tried.		
Total	47,000,000	235,000

The allowances for 1919 and following years take into consideration the utilization of at least 23,000,000 kw.-hr. additional water power from the above sources. Any further betterment of conditions must come from additional hydroelectric developments.

For the years following 1918 the various companies have under consideration possible hydroelectric developments, which in conjunction with the available natural gas resources could save the equivalent of the entire oil requirements for 1921.

	Kw.-hr. per Year	Equivalent Barrels of Oil
1. The most immediate of these is the possibility of installing certain plants on the Los Angeles aqueduct which are partly developed and which could be ready by 1919, capable of supplying	100,000,000	500,000
2. The Edison company has a program of development on Kern River and Big Creek for completion in 1919, 1920 and 1921, which can supply	400,000,000	2,000,000
3. San Joaquin can construct plants on the San Joaquin and Kings River, which can supply	200,000,000	1,000,000
4. Southern Sierras can complete plants to supply	150,000,000	750,000
Total	850,000,000	4,250,000
The total estimated cost of the proposed developments is approximately	$30,000,000	

It will be noted that with proper interconnections between the companies the developments considered in the last table are capable of producing 850,000,000 kw.-hr., or 245,000,000 more than the 605,000,000 which must be produced by steam in 1921 if hydroelectric development is not carried out. This surplus would be available for additional growth of the companies and it would not be necessary to complete some parts of the proposed developments until the load became sufficient to absorb the output.

Extensions of distributing systems are taken up in the report. During the emergency created by the war, and in view of the present shortage of money and expected shortage of materials, extensions of distributing systems, aside from very minor extensions, should be confined to extensions to serve consumers whose business contributes directly or indirectly to the winning of the war, the committee says. For the present, and until the shortage of materials becomes more acute, extensions to prospective consumers willing to deposit a substantial part of the cost of extensions, to be refunded in service, or the gross income from which will equal the cost of the extension in two years or less, might be made.

In southern California approximately 90 per cent of the electric energy sold is used for street and interurban railways, irrigation for agriculture, cement manufacture, oil-well pumping, shipbuilding and minor power service, all of which are war necessities.

It is suggested by the committee that the commission consider the question of passing upon applications of the utility companies for priority shipments for the purpose of giving the applications more standing before the Priority Board in Washington and eliminating the present apparent necessity for individual efforts in securing priority.

The financing problem, says the report in conclusion, is by far the most important one to be met. Large amounts of money are needed to permit of either the conservation of fuel oil or the development of water power for war purposes. No practical method of financing has as yet developed to provide funds for additional water-power plants contemplated. If a priority board were created by the United States government to pass upon the sale of securities, precedence would undoubtedly be given the sale of those securities which would provide funds for hydroelectric developments and the requisite extensions for the conservation of fuel oil, the development of agricultural lands, or other war necessities. The question of necessity might be certified by the commission for submission to such a priority board.

HIGHER RATES TO COVER COAL, MATERIALS AND LABOR

Sayre Electric Company Increases Schedule to Take in Other Elements of Increased Operating Expense Besides Fuel

The Sayre (Pa.) Electric Company has filed an increased-rate schedule with the Pennsylvania Public Service Commission. It covers higher costs of coal, other materials and labor. All meter rates, other than those for temporary service, are to have variable charges added, as follows:

A charge of 0.6 mill per kilowatt-hour will be added for each 25-cent increase in the cost of coal above $3.70 per gross ton delivered at the plant of the company.

A charge of 1.5 mills per kilowatt-hour will be added to cover the increased cost of labor and material.

In like manner for every 25-cent decrease in the cost of coal below $3.70 per gross ton delivered at the plant of the company the price shall be reduced 0.6 mill per kilowatt-hour of electricity consumed.

ILLINOIS COMMISSION ACTS ON CREDITS AND DEPOSITS

Tentative Rules Promulgated for Hearing at Springfield This Week Governing Electric, Gas, Water and Heating Service

The Public Utilities Commission of Illinois set Feb. 13 as the date for a hearing at Springfield on tentative rules governing the establishment of credits and the collection and handling of consumers' deposits for electric, gas, water and heating service.

The features of the tentative rules which the commission has worked out are that before rendering service the utility shall require each customer to establish his credit, that the amount of the cash deposit shall be equal to the average bill, including prompt payment discount for a periodic billing period plus thirty days, that the minimum cash deposit is fixed (except for power and heating service) at $3 for residence customers and $5 for business customers, that twenty days is established as the period which shall elapse between the issuance of a bill and the date on which the customer is adjudged delinquent, that prompt payment of all bills for twelve months permits the customer to demand and receive his cash deposit, and that interest at 6 per cent shall be paid on all deposits held by the utility for more than six months.

ALLOWING HIGHER RATES TO RELIEVE EMERGENCY

Method of Illinois Commission in Giving Relief to Utility Which Must Raise Power Rates to Meet Rising Costs

The State Public Utilities Commission of Illinois, deciding on the petition of the East St. Louis Light & Power Company for authority to increase wholesale power rates, expedited the case by making a comparison of the rates with other rates. The commission said in part:

There is submitted in the record no valuation. The usual procedure might involve a valuation and an analysis of the operating expense. The record contains little such information except that relating to increased expenses of operation.

It must be realized that, owing to high prices of fuel, labor and the materials necessary for carrying on utility operation, public utilities must have experienced increases in operating expenses. This fact in itself, however, does not offer justification for an increase of rates, since it is possible that the rates heretofore charged under more normal conditions which have previously existed were exorbitant or excessive. If, however, it can be reasonably shown that the rates heretofore in effect under normal conditions have not been unreasonably high, then the problem is narrowed down to a determination of whether the rates proposed will give increased revenue of an amount which will adequately, but not unreasonably, reimburse the utility for the increases of operating expense that obtain, and whether the proposed rates are of a non-discriminatory and equitable character. In a number of such cases the commission has entered orders fixing rates for utility service. A comparison with rates so fixed and determined offers an opportunity for the formation of judgment which may be sufficiently accurate in many cases.

Testimony shows that the average cost of coal delivered at the company's plant during the first nine months of 1916 was $1.25 per ton; during the first nine months of 1917 the cost was $1.87 per ton. The company estimates, upon the basis of contracts which it has and the present prices prevailing, that the average cost of coal used by it from Nov. 1, 1917, to April 1, 1918, will be $2.69 per ton, and that after April 1, 1918, when all of its present coal contracts will have expired, this cost will be $2.74 per ton.

After a comparison of the power rates with those in other communities and finding that East St. Louis rates were lower, the commission pointed out that the rates it contemplated were applicable only to wholesale power service, and stated:

Power service in general, and wholesale power service in particular, is a competitive class of service for the reason that consumers of power service are usually in a position to utilize power furnished by other means. The "value of the service" to the consumer is an element to be properly recognized in the development of rates for utility service, at least to the extent that it fixes a maximum above which rates cannot be fixed with the hope of securing business.

The commission ordered suspension of the company wholesale rates in order that new and higher rates might be effective as of Jan. 1, 1918. The commission will retain jurisdiction in order that changes of conditions as they may arise may be cared for adequately. The commission reserves the right to re-open this case if in its opinion conditions warrant.

CONSTRUCTIVE REGULATION IN THE PUBLIC INTEREST

Empire State Gas and Electric Association, Calling Attention to Destructive Railroad Regulation, Urges Efficiency

Declaring that the suspension of industries is due to freight congestion arising primarily from railroad regulation and urging the importance of constructive regulation of utilities to promote efficiency and prosperity, the executive committee of the Empire State Gas and Electric Association has sent the following resolution to the United States Chamber of Commerce:

Whereas the federal government, through the United States Fuel Administration, has found it necessary temporarily to close down business in the eastern part of the country in order to relieve freight congestion and insure thereafter a continuous flow of coal and other articles necessary for domestic use, for the use of our army and navy, and for export to our allies in the war; and

Whereas the present freight congestion is, in our judgment, due to a long period of regulation of the railroads, by state and federal authorities, of a character which has been unnecessarily burdensome and restrictive and which has impaired the credit of the railroads, thereby preventing them from securing promptly and at reasonable prices the capital needed for extensions, additions and improvement; and

Whereas all other public utilities, including electric railways, gas corporations, electric light and power corporations, telephone and telegraph companies, water companies, etc., are also of vital necessity to the country not only in times of war but also in times of peace and are now almost everywhere subject to regulation by governmental bodies; and

Whereas these utilities can render the maximum service only if their credit is maintained and they are enabled to secure capital promptly and at reasonable rates, now be it

Resolved, that we request the Chamber of Commerce of the United States to lay this matter before the business men and business organizations of the country, suggesting that they as users of the service rendered by such utilities express themselves to federal and state legislative and regulatory bodies in opposition to restrictive regulation but in favor of regulation which will encourage efficiency, prosperity and co-operation as being in the public interest, and which will see to it that such prosperity and efficiency inure to the benefit of the public, to the end that further calamities due to the inability of the public utilities to meet the demands of the public may be averted.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

The Southwestern Electrical and Gas Association.—This association will hold its annual convention April 15 and 16 at Galveston, Tex. H. S. Cooper of Dallas, Tex., is secretary of this association.

New York Chapter of American Association of Engineers.—Hudson H. Bubar of the National Aniline & Chemical Company addressed the New York Chapter of the A. A. E. recently on "The Engineer: His Present and Future."

Los Angeles Synchronous Club.—"Illumination" was the subject of Lecture No. 8 in the synchronous electrical course given at the Feb. 7 meeting by Prof. A. W. Nye, head of the physics and electrical engineering department, University of Southern California.

Pittsburgh Section A. I. E. E.—On Feb. 13 C. E. Wilson, automotive engineer, Westinghouse Electric & Manufacturing Company, addressed the Pittsburgh Section of the American Institute of Electrical Engineers on the subject of "Electrical Equipment on Government Standardized Trucks." G. M. Baker is secretary of this section.

San Francisco Electrical Development and Jovian League.—The league at its Feb. 6 meeting celebrated the birthday of Thomas A. Edison. Frank D. Fagan, Pacific Coast manager Edison Lamp Works, gave an interesting talk on incidents in Mr. Edison's life, illustrated by moving pictures. E. M. Cutting, Pacific Coast manager Edison Storage Battery Supply Company, was master of ceremonies.

Louisville Jovian League.—At the annual meeting and banquet of the Louisville (Ky.) Jovian League there was an attendance of nearly 100. A spirited election with two tickets, a so-called regular ticket and a "camouflage" ticket, was held. Walter S. Clark of the James Clark, Jr., Electric Company, was elected to serve a year as president, succeeding himself. He was elevated to the presidency last fall on the removal from the city of F. V. Gantt, the previous president. On the ticket with him were elected C. C. Childers of the Childers Electric Company, vice-president, and Paul C. Tafel of the H. C. Tafel Electric Company, a director. From the other ticket were elected S. B. Storm of the local branch of the General Electric Company, secretary-treasurer, and the following directors: James Clark, Jr., of the James Clark, Jr., Electric Company; C. A. Klemm, branch manager of the Westinghouse Electric & Manufacturing Company, and I. Dreyfus of the Louisville Gas & Electric Company.

Officers of the American Washing Machine Manufacturers' Association.—At the second annual meeting of the American Washing Machine Manufacturers' Association, Jan. 23 and 24, 1918, the following officers were elected: President, W. H. Eden, Brokaw Eden Manufacturing Company, Alton, Ill.; first vice-president, H. W. Barker, 1900 Washer Company, Binghamton, N. Y.; second vice-president R. D. Hunt, Drexter Company, Fairfield, Iowa; third vice-president, John Rocks, Meadows Manufacturing Company, Pontiac, Ill.; treasurer, W. H. Voss, Voss Brothers Manufacturing Company, Davenport, Iowa. The executive committee members are W. J. Conlon, Conlon Electric Washer Company, Chicago; W. L. Rodgers, Pittsburgh Gage & Supply Company, Pittsburgh; J. D. A. Johnson, Michigan Washing Machine Company, Muskegon, Mich.; F. H. Bergman, One-Minute Manufacturing Company, Newton, Iowa, and H. G. Braunlich, H. F. Brammer Manufacturing Company, Davenport, Iowa. On the advisory committee are Sam T. White, White Lily Manufacturing Company, Davenport, Iowa; L. E. Dietz, Boss Washing Machine Company, Cincinnati, Ohio, and E. H. Maytag, Maytag Company, Newton, Iowa. Messrs. Eden, White, Dietz, Johnson and Rodgers are the war service committee. Raymond Marsh, 10 South LaSalle Street, Chicago, is secretary.

Gilchrist Speaks on Financial Problems.—John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, speaking at a recent meeting of the Indiana Engineering Society at Indianapolis, characterized the financial problem of the public utilities as the most important before them. The government has become aware, he said, that power is of use in the war and that it must call out a greater power than man power to maintain the men at the front. Public utilities, therefore, are among the essential industries as regards war work. In the discussion H. O. Garman of the Indiana Public Service Commission stated that a number of Indiana companies are already insolvent on account of increasing cost of operation. Mr. Garman also argued against extensions to outlying districts, stating that these are not necessary inasmuch as the average American city has not been built up intensively and contains much waste space. G. W. Hubley of Indianapolis cited figures on increasing costs to show that the more common materials had increased all the way from 20 per cent for common brick to 199 per cent for copper, while the wages paid laborers had advanced from 25 to 50 per cent with a decrease in the effectiveness of the workers. W. S. Moore, state highway engineer for Indiana, was elected president of the Engineering Society; G. A. Young of Lafayette was elected vice-president, and J. S. Wilkins of Connersville and W. H. Insley of Indianapolis were made members of the board of trustees. Charles Brossman of Indianapolis was re-elected secretary.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates Suspended in Illinois.—The Illinois Public Utilities Commission has suspended the increase asked by the Madison County Light & Power Company, Carlinville, until March 31; also, to the same date the increase in rates proposed by the Abbott Light & Power Company for Petersburg, Mason City, Tallula and Ashland.

Need of Proper Capital Authorization.—A decision has been rendered by the New York Public Service Commission, Second District, on the petition of the Groton Electric Power Corporation for permission to construct a plant in Groton and near-by communities. The commission ruling, in brief, follows: "An electric company applied for permission to construct and for approval of franchises in certain villages and towns where there is a decided need for electric service. The company was not yet fully organized as a corporation. It had filed its certificates but had obtained no authorization for capital stock from this commission. In the circumstances it was held that the application should be granted but that no construction should be undertaken until proper capital authorization from the commission should be secured."

Power Supply in Portland, Ore.—The power situation is discussed incidentally in a decision of the Oregon Public Service Commission affecting the Portland Railway, Light & Power Company. "It is evident," says the commission, "that even at this time the power supply is but little, if at all, in excess of the demand, after making allowance for a proper reserve. But now, after a period of comparatively slow growth, the demand for power is increasing rapidly. The Northwestern Electric Company has just announced its intention to build a 10,000-kw. steam plant in the city, and it is reported that it will also add a small hydro plant on the White Salmon River. But these will not more than take care of the anticipated increase of the next one or two years. With the advent of the shipbuilding industry and the great improvement in the lumber business and kindred lines, a large increase in industrial activity is confidently looked for. If this growth is not to be blighted by inability to supply power for it, it is essential that the development of additional power on a large scale be undertaken in the very near future, and to this end it is necessary that the utilities engaged in the supply of power shall be maintained in such credit as will enable them to obtain the funds required for such development."

Doherty Headquarters in Washington.—The Doherty Men's Club has been established at 1329 K Street, N. W., Washington, for the convenience of men of the Doherty Organization who have occasion to visit Washington.

Purdue Includes More Army Work.—As the result of a conference held in Washington upon the request of the Signal Corps, U. S. A., Purdue University decided to inaugurate an additional signal course. It began with the second semester of the school year, Feb. 1. The course will be under the direction of Prof. C. Francis Harding, professor of electrical engineering.

Byllesby Men in National Service.—A "national service record" of employees of H. M. Byllesby & Company and affiliated employees as of Jan. 1, 1918, shows: Number of male employees at properties, all ages, 4839; number enlisted, 317; number drafted, 79; number subject to draft not yet called, 996; total number of men in active service, 393; percentage of men in service of entire male forces employed, 8.1 per cent.

Research Fellowships in the Engineering Experiment Station, University of Illinois.—To extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen engineering experiment station research fellowships. One other such fellowship has been established under the patronage of the Illinois Gas Association. The fellowships, for each of which there is an annual stipend of $500, are open to graduates of approved American and foreign universities and technical schools.

Asks Suspension of Extension Regulations.—A. D. Mackie, general manager Springfield (Ill.) Gas & Electric Company, has asked the Illinois Public Utilities Commission to suspend general rules Nos. 19 and 31 as applied to public service corporations. Section 31 provides generally that an individual or group of individuals may compel building and maintenance of lines for transmission of electric power, subject to certain regulations. Section 19 applies similarly to gas installations. Mr. Mackie asks suspension of these during the war. He says that cost of construction, materials and labor is so high as to make service extensions unprofitable in most cases.

University Extension Course in Fuel Economy.—To overcome the great wastage in fuel in Massachusetts because of lack of expert knowledge by firemen and others who use coal in large quantities, the Department University Extension, State Board of Education, organized a class in power plant economics, scheduled to begin sessions on Feb. 4, at the State House, Boston. James A. Moyer, director of the department, said that the principal object is the distribution of easily understood information of how to obtain full worth from every pound of fuel in industry. The course is to be given by J. J. Eames, instructor in mechanical engineering in the department of university extension, under the auspices of the Massachusetts Institute of Technology.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Increase Rates in Mobile.—The Mobile (Ala.) Electric Company has increased electric rates, effective Feb. 1, owing to increased operating expenses caused by the war.

Illinois Rate Increases.—The petition of the Public Service Company of Northern Illinois to increase electric light and gas rates in 140 towns and cities has been received and reviewed by the Illinois Public Utilities Commission. The commission has postponed the effective date of the increase until June 28, 1918.

Guide for Electric Vehicle Owners in New York.—The New York Edison Company, through the automobile bureau, is distributing the 1918 edition of the charging station booklet. The book is especially valuable as it shows severel new charging stations in the suburbs. In addition it describes the electric vehicle route to Atlantic City. There are several additions of interest in the 1918 compilation.

Cleveland Rate Case Before Commission.—The hearing on the city of Cleveland appeal for reduction of the Cleveland Electric Illuminating Company rate was resumed before the Ohio Public Utilities Commission on Jan. 29. After partial cross-examination of Robert Lindsay, general manager, the hearing was adjourned to Feb. 20. The city contended that its engineer, F. W. Ballard, had not had sufficient time to prepare his review. Company attorneys informed the commission that the company would probably be compelled to discontinue the steam-heating business unless allowed to raise rates.

Water Power at Sault Ste. Marie.—The Sault Ste. Marie (Mich.) Civic and Commercial Association writes to the ELECTRICAL WORLD: "All the large industrial plants at Sault Ste. Marie are running as usual under special exemption by Dr. Garfield and W. K. Prudden from their recent drastic fuel orders. These plants are operated by electricity produced by water power from the rapids of the St. Mary's River. The Michigan Northern Power Company and Edison Sault Electric Company produce and distribute about 40,000 hp. from these rapids. This power is used to operate all industries of any size at the Sault. There is now immediately available at the Sault about 1500 hp., which can be increased to 4500 hp. upon very short notice and the installation of the type of machinery most efficient for the operation of any particular industry. Under the present fuel conditions this available water power is of great economic advantage to manufacturers who are or may be embarrassed for lack of fuel."

New Rules for Priorities.—The priorities division of the War Industries Board of the Council of National Defense has issued new rules and regulations governing priority. They set forth that "the paramount purpose of priorities is the selective mobilization of the products of the soil, the mines and the factories for direct and indirect war needs in such a way as will most effectually contribute toward winning the war. In requesting priority the petitioner should join the committee in applying this test: To what extent, if at all, will the granting of this application contribute, directly or indirectly, toward winning the war; and if at all, how urgent is the need?"

Appeal to the Public in Illinois.—A united appeal to fair and unbiased public opinion has been made by the Illinois State Electric Association, the Illinois Gas Association and the Illinois Electric Railways Association. The three associations are using direct newspaper appeal to the people for a fair deal in the matter of rapidly increasing costs of operation in view of a steady and inflexible revenue account. They point out especially that while utilities should not be allowed to make unjust profits on large amounts of watered stock, they should be allowed to earn a revenue fully commensurate with greatly increased costs of operation and should be protected against soaring prices of labor and materials by higher rates. The appeal has appeared in a number of prominent Illinois daily newspapers.

Engineers in Government Service.—During the last few months the Engineering Council, through its American engineering service committee, has supplied to various government departments and bureaus several thousand names of engineers from which men were to be selected for positions in uniformed and civilian service for the army and navy and other government activities in connection with the war, as well as for indirect service for manufacturers and contractors in government war work. To meet these demands the American engineering service committee assembled in its offices, Engineering Societies Building, New York, extensive lists and detailed information concerning engineers in all branches of the profession throughout the land. If these lists are to be maintained in the most useful condition to the government and the Engineering Council the committee should receive prompt information concerning each engineer who has gone into any kind of government service, direct or indirect. Engineers to whom this request applies are urged to send at once their names, present addresses and occupations in the government service, with brief statement as to whether or not they are available for other service, to the American engineering service committee, Room 901, 29 West Thirty-ninth Street, New York. Other readers are asked to bring this request to the attention of such engineers or to send information directly to the committee named.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Henry Bostwick, formerly secretary to the vice-president and general manager of the Pacific Gas & Electric Company, has been chosen to succeed G. C. Holberton as manager of the San Francisco district of the company.

George C. Holberton, for several years manager of the San Francisco district of the Pacific Gas & Electric Company, has handed in his resignation, effective Feb. 1. Mr. Holberton is retiring in order to devote all of his time to private affairs.

J. M. Hannaford, Jr., vice-president and sales manager of the Northwestern Electric Equipment Company, St. Paul, Minn., has resigned to enter the firm of Gordon & Ferguson, St. Paul. Mr. Hannaford has been with the Northwestern company for nine years.

Z. Starr Cohen, who has been connected with the Northern New York Utilities, Inc., at Watertown, has been appointed manager of the Wetmore Electric Company at Lowville, N. Y., a subsidiary of the Northern New York Utilities, Inc. Mr. Cohen succeeds George R. Dorsey, who has resigned.

H. W. Deininger, for several years vice-president and general manager of the Sac City Electric Company and for the last two years manager of the Sac City district for the Iowa Light, Heat & Power Company, has resigned to become general superintendent of the Iowa Southern Utilities Company, with headquarters at Centerville, Iowa. Prior to entering the electric utility field Mr. Deininger was general manager of the Globe Machine & Supply Company.

Frank L. Lucas, president-elect of the Western Association of Electrical Inspectors, started in the electrical business in 1884 as an electrician in Detroit, Mich. Later he went to Toledo as superintendent of construction for a contracting firm. In Toledo he helped to organize the inspection department of the city and made the first municipal electric inspection. In July, 1917, after eleven years of service, he resigned to go into business for himself in Toledo. In addition to his inspection activities, he was also connected with the La France Electrical Construction & Supply Company of that city.

F. L. LUCAS

J. J. Gorman has been appointed new-business manager of the Citizens' Gas & Electric Company, Waterloo, Iowa.

W. Porter Jones has resigned as manager of the Oklahoma Gas & Electric Company at Norman, Okla. Prior to becoming manager at Norman a year ago Mr. Jones was new-business manager of the company.

B. E. Morrow, who has recently been elected a director of the National Safety Council, has always been an ardent advocate of safety work and the prevention of industrial accidents. He has been very active in this work, having been a member of the committee on dangerous machinery appointed by the Department of Labor, New York City; a member of the committee on accident prevention of the National Electric Light Association and chairman of the safety practices committee of the public utilities section of the National Safety Council. Mr. Morrow is one of the pioneers in the electrical industry, having been connected with the Edison Electric Company at Schenectady in its early days. After the consolidation of that firm with the present General Electric Company he had charge of the electrical testing department. In 1902 he resigned from the General Electric Company to take charge of the operating department of the Hudson River Power Transmission Company, the principal generating station of which at that time was on the Hudson River at Mechanicsville, N. Y. In 1903 this company, with several others, was merged into what was known as the Hudson River Electric Power Company, with hydroelectric plants at Spier Falls, Mechanicsville and Schoharie Falls and a 6000-kw. steam generating station at Utica, N. Y. While connected with this company Mr. Morrow made an extended trip to the Middle Western States and to Canada with Dr. Steinmetz, Professor Creighton and other prominent engineers to inspect lightning arresters on high-tension transmission lines. This was before the advent of the aluminum-cell lightning arresters, and the multigap arresters then in use were the cause of much anxiety on the part of engineers. In 1910-11 he was chairman of the N. E. L. A. committee on protection from lightning and other static disturbances, and he has served on many other important committees. At the present time he is a member of the N. E. L. A. committee on inductive interferences. In 1915 Mr. Morrow was appointed manager of the production and transmission department of the Consumers' Power Company, Jackson, Mich, a post he still holds.

F. D. Beardslee has resigned as sales manager of the Union Electric Light & Power Company, St. Louis, Mo., to become manager of the department of public relations of the Mercantile Trust Company of St. Louis. He will retain the position of assistant secretary of the Union company on consultation matters. Mr. Beardslee has been connected with the lighting company since 1889, having started as a boy.

A. B. Boynton, district manager of the Electric Machinery Company for New York and New England, has recently been commissioned captain in the Engineer Officers' Reserve Corps. Captain Boynton is a graduate of Cornell University in electrical engineering and for the last twenty years has been engaged in engineering and sales work in the electrical field.

A. B. BOYNTON

H. E. Hobson, an electrical engineer, who was superintendent of construction for Sampson & Allen of Lynn, Mass., for seven years, general manager of the Central Hudson Construction Company for three years and general manager of the Poughkeepsie Utilities Corporation for the last four years, has been appointed by the Underwriters' Association of New York State as an electrical inspector. Mr. Hobson will have charge of the electrical department in the branch office of the association at 45 Market Street, Poughkeepsie, N. Y.

Obituary

M. G. Potts, formerly connected with the Lykens Valley Traction Company, Williamstown, Pa., in the capacity of treasurer and general manager, died Jan. 18 at his home in Harrisburg, aged seventy-three years.

B. Frank Hires, formerly connected with the Bridgeton & Millville Traction Company and the Bridgeton Electric Company, Bridgeton, N. J., in the capacity of general manager, died Jan. 18, aged fifty-nine years. Mr. Hires was appointed special agent in the spring of 1917 for the American Railways Company, which operates the above properties.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

SERVICE CHARGE FOR THE SMALL ACCOUNTS

Suggestion Is Made that Customers Be Advised to Trade with a Lesser Number of Distributing Houses

A Middle Western jobber, through circular letters and through his salesmen, is telling customers the cost of handling small orders and is giving the reason for asking a 10 per cent service charge on returned goods. This jobber recently stated that he had yet to find an instance wherein a customer objected to such policy. Moreover, he expressed a high appreciation of the attitude taken by competitors, who evidently instructed salesmen not to use the knowledge of this campaign against his company. Evidently the competitors believed it to be constructive work which would promote their best interests as well as his.

This jobber is of the opinion that if every distributer would analyze his account, he could do much to overcome this fault by writing those customers who continue to send small orders repeatedly. He could ask for fewer orders but larger amounts at a time. In some cases it would be money actually saved if these jobbers would request the customer to trade with fewer houses. In this way some customers would cease trading; others would cease trading with competitive houses, and on the whole, it is believed, everybody covering the territory would be benefited. There is only a given amount of merchandise to be sold; each buyer has only a certain volume to place. If he places it with fewer houses, each house should profit because each will eliminate many small orders. Most distributers and salesmen, this jobber believes, get too anxious to sell merchandise, and overlook the necessity of analyzing their accounts and of discontinuing business that is not profitable to them.

FEDERAL RULES FOR OBTAINING PRIORITIES

Circular No. 3 Defines Rules for Determining Precedence in Orders and Work and Describes the Methods of Administering Them

The priorities division of the War Industries Board of the Council of National Defense has made public Priority Circular No. 3, defining the regulations which the priorities division now has in effect for determining precedence in orders and work and describing the methods of administering them. The regulations are subscribed to by the Secretary of War, the Secretary of the Navy, the chairman of the Shipping Board and president of the Emergency Fleet Corporation and the chairman of the Council of National Defense. The circular discloses a much wider field of operations than that defined in the first circular issued in September of last year. The priority regulations apply to all individuals, firms, associations and corporations engaged in the production of copper, iron and steel and in the manufacture of their products; of chemicals, cotton duck and woolen cloth, and all such other raw materials and manufactured products as the committee may deem necessary from time to time.

Under the new regulation all orders and work are divided into four general classes instead of three as heretofore: Class AA, class A, class B and class C, with such subdivisions as class AA-1, class AA-2, etc., class A-1, class B-1, etc. Class AA comprises only emergency war work of a special or urgent nature.

The new regulations in no way change or modify any priority orders previously issued. The rule of procedure from now on is that orders and work in class AA shall take precedence of those in all other classes, orders and work in class A preceding those in class B and those in turn orders and work in class C, irrespective of the dates the orders were placed. The committee's work does not cover transportation, and it does not attempt to expedite transportation.

No industry, plant, material or commodity will be classified as such. Only specific orders for materials, commodities or work are classified according to their importance in war preparation or in work necessary to the public interest and essential to the national welfare, or otherwise of exceptional importance.

SUGGESTIONS FOR EXPANDING SOUTH AFRICAN EXPORT TRADE

Preference for Higher-Class Merchandise — The Manufacturer's Agent Is Found a Better Medium than Exclusive Sales Houses

A manufacturer's agent at Johannesburg, South Africa, in writing of trade conditions to the ELECTRICAL WORLD, makes some observations that are intended to be of direct interest to American manufacturers in the advancement of their export business. In a preliminary way he asks how American manufacturers are viewing the coming keener competition that they must necessarily meet after the war from Great Britain and continental Europe, not to mention Japan, all now competing in electrical goods in this and other markets. The belief expressed is that American producers will have largely to change their methods.

Following a brief description of the peculiar character of the population and of the communities, the correspondent says that largely the towns began where the Old World left off. Apart from three or four, gas is unknown, and even in these electricity has the foremost place because of its convenience and moderate cost. The smaller towns, some of which cannot be described otherwise than as villages, are installing both electric light and electric power, while the great gold mines of Johannesburg and the diamond mines of Kimberley are worked from electric power stations.

The demand for the conveniences which electricity makes possible is rapidly growing and the preference is for the higher-class articles. In meeting this demand America is well represented, but there are still possibilities untouched. A more intimate knowledge and a closer survey of the field would benefit American manufacturers, and provided that they would admit that policies adapted to their domestic market may not always be the best for the export territories, they could do still better. South Africa is emphatically a market in which the manufacturer's agent should be employed as opposed to the practice common with American firms of granting sole agencies. The outlook for the next few years is undoubtedly brighter than it has been hitherto in that country.

Individual electric lighting plants are in growing demand, and these will be followed by a desire for the various conveniences which help to lessen the labor of housework, as the servant question is as acute over there as it is in the United States. Such plants must be non-complicated, of strong construction, and use kerosene as fuel, for gasoline costs to-day $1.02 per imperial gallon. If equipped with storage batteries and attachments for driving the churn or butter worker, this would be an additional selling point.

Unfortunately, South African electric service has not been standardized, and the merchant has to provide for the fact that the voltage in the different towns is not alike. Even in Johannesburg it differs in different portions of the town. It might also be well to remind American manufacturers that only the bayonet socket is in use in South Africa, the screw, so common in the States, being unknown.

THINGS TO BE CONSIDERED IN TAKING GOVERNMENT WORK

Information Concerning Localities in Which Orders Will Not Be Placed and Effect of Other Government Orders

In the matter of placing contracts for goods for government use, the General Engineering Depot, Washington, D. C., in asking for bids is requiring of bidders, "because of the known shortage of power in certain manufacturing districts and in order to conserve this power for the rapid completion of government contracts already under way," to state on demand the localities from which the materials entering into the manufactured articles are obtained. The purchasing officer in this way reserves the right in making awards to discriminate against those bidders who are dependent for their materials upon the manufacturers in congested districts.

In addition, in order that there may be no congestion in factories and that there may be more equitable distribution of goods, bidders are required to state in writing upon the request of the purchasing officer, after proposals are opened, the total money value of uncompleted orders placed with them by the United States and the allied governments. In addition, bidders must also state at that time the class and number of principal and subsidiary priority orders which may have been issued on their manufactured goods affecting directly or indirectly articles upon which they are bidding.

METAL MARKET SITUATION

Copper Shipped Regularly—No Strain to Meet the Demand—Wire Steady and Firm

With the change in weather conditions shipments of copper are being made more regularly. An authority states that if surface appearances are to be trusted, the trade, as regards supply and demand, will be under no strain for the metal in the near future. Wire is now figured on a 30-cent base, with practically negligible fluctuation. A large distributer reports that a special discount is conceded to heavy buyers of rubber-covered, base, weatherproof or cable. Each transaction is considered individually. The embargoes are upsetting all calculations on shipments and deliveries. An improvement, however, is looked for.

Shortage of tin is causing anxiety in metal circles. None is expected before March, only 200 tons having reached here from the Straits from Feb. 1 to Feb. 8. Old metals are steady, with a better price being quoted for heavy brass and scrap zinc.

NEW YORK METAL MARKET PRICES

	Feb. 4	Feb. 11
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00	27.00
Lead, trust price	6.75	6.75
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.92½	7.92½
Tin, Straits	85.00*	85.00*
Aluminum, 98 to 99 per cent	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.75 to 15.00	14.00 to 15.25
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.00 to 6.25	6.00 to 6.25
Zinc, old scrap	5.00 to 5.50	5.50 to 5.75

*Nominal.

THE WEEK IN TRADE

BARRING the embargoes and freight congestions which in some sections, particularly along the Atlantic seaboard and Pacific Coast, are distressing, business in the electric line is most encouraging. Contracts for equipment and goods of every description for shipyards, industrials and housing are running into the highest figures known. In the distribution of sales the entire trade is participating, either directly or indirectly. The approach of spring is therefore regarded with equanimity by manufacturers, distributers, jobbers and dealers.

Stocks are reported in satisfactory condition, with a few exceptions. A shortage of small motors is noted in some sections, with an ample supply and better deliveries elsewhere. Conduit of every size is in bad shape, with an increasing demand. Heating appliances, especially radiators, are having the best sale on record. Household specialties, especially sewing and washing machines, are also easy sellers.

Collections are holding up well, being reported as ranging from excellent to slow. Applications for credit are bearing the closest scrutiny, with jobbers refraining absolutely from financing doubtful prospects.

NEW YORK

A spirit of buoyancy is noted in the electrical goods field which freight congestions, embargoes, backward deliveries and fuelless days seemingly fail to affect. Jobbers and distributing companies are fortifying their stocks, and while it is difficult to keep all lines at full strength, owing to curtailed production in some instances and in other cases to transportation embargoes and delays, still the quantity of merchandise on the shelves or in warehouses represents a fair supply. Business is at least 50 per cent better than last year. Orders on hand are very heavy, in industries allied with iron and steel, for engineering equipment and electrical staples and specialties. Improved buying conditions are reported in the trade. Prices have been expected to recede in certain goods, but no tendency in that direction is yet noticeable.

Collections are accepted as being about as good as conditions will warrant, with dealers buying cautiously in view of the high level of prices. Credits are carefully looked after, so that the financial aspect of affairs is regarded as favorable.

CODE WIRE.—With building operations at the lowest ebb in several years the sale of code wire is not brisk. Rubber-covered, weatherproof and cable are in sharp demand, the price being figured on a 30-cent to 32-cent base. Producers are busy with large government orders, and their plants are taxed to meet specified shipping dates.

TORCHES.—There is an active market for torches for outdoor use by electricians and linemen. The advance of 10 per cent made Dec. 1 still rules. Deliveries by express are put through in a few weeks. To nearby points shipments are prompt.

COLLECTIONS AND CREDITS.—With the approach of spring an effort to place their collections in a strong position is reported among jobbers. Dealers are also taking the cue in their relations with the consumer. Credits continue to receive the attention their importance demands at this time.

MOTORS AND TRANSFORMERS.—Prices are unchanged, but up to 20 hp. motors are quite prompt in shipment. Transformers also show a like improvement.

LIGHTING FIXTURES.—Sales are reported as increasing in bowls, basins and shades with the approach of spring. Deliveries are subject to embargoes. On Feb. 1 the pack-

ing charge at the factory was advanced from 25 per cent to 33 1/3 per cent. Goods in this class are all quoted f.o.b. factory at buyer's risk.

CONDUIT.—Stock is running low. Prices are not considered, jobbers report, when buying. Delivery is the main question. There is no fixed price, and only emergency orders are now accepted by jobbing houses, which are not allowing any more conduit to pass out of their hands than cannot be avoided. There is any quantity of conduit at the mills, but embargoes cut off shipments. This applies to all sizes. When the weather eases off a few weeks of mildness will change the entire outlook. An order for 50,000 ft. was recently placed by a local utility, f.o.b. mill. The jobber who booked this nice piece of business said this is the only way to sell conduit nowadays. The risk is too great otherwise.

LAMPS.—Manufacturers are said to have caught up with the shortage variously described a short time ago. There is no stringency now, reports say, the producers having gone over stocks and made a better assortment for all concerned.

RADIATORS.—Goods have been coming into this market in such quantity that the heavy demand is now being taken care of.

HEATING CORD.—No. 16 heating cord is scarce. It is said the price is high and fluctuating. One manufacturer quotes $38 to $38.50, another $29.70.

CHICAGO

Heatless Mondays, transportation troubles and inclement weather are leaving their marks on the trade in the Chicago territory. Among the manufacturers it is freely stated that the elimination of working days has cut down production. This decrease, moreover, has not been in direct proportion to the number of days involved. The decrease is greater than that ratio. This is due to several causes. First, it takes the men some time to get into the swing again after a day and a half lay-off. Moreover, electrical manufacturers find that other factories which supply semi-finished parts or raw materials are also hard hit by the shut-down delays and transportation tie-ups, so that hindrance arises here again.

This same situation can be traced through into the jobbing industry, where it will be found that goods promised for three weeks' delivery are taking five weeks or more to arrive at jobbers' warehouses. This, of course, increases the value and usefulness of jobbers' stocks in this territory. Certain jobbers are out of some lines that they themselves say they have no business to be out of. So far there has been no effort on the part of jobbers to raise prices to the trade on items in stock. As long as stocks hold out, it is said, they will be sold at existing prices.

In the city of Chicago for the week ending Feb. 6, 1918, there were issued 395 electrical permits, as against 620 for the same week last year. The 395 permits involved installations of 5044 incandescent lamps and 736 hp. in motors. Electrical permits for this year are running behind those of last year on the average, as is shown by the fact that 1850 were issued for the five weeks ended Jan. 30, 1918. Two thousand six hundred and twenty-three were issued for the five weeks ended Dec. 26, 1917, and 3260 were issued for the five weeks ended Jan. 30, 1917.

It is definitely known that one gun-carriage factory and two shell plants have signed up for central-station service in Chicago. The gun-carriage plant will have a total connected motor load of 2000 hp., and the shell plants will have 1500 hp. and 2800 hp. connected respectively. Two other similar plants are in contemplation which will have an aggregate of 5000 hp. These are expected to be signed up at any time.

COPPER WIRE.—The prices remain unchanged. Deliveries from jobbers to manufacturers are uncertain. Cars in transit are more than two weeks overdue.

CONDUIT.—Deliveries are still in a difficult state. "Shopping" is usually necessary to get any quantity of varied sizes.

PORCELAIN.—Owing to frequent warnings issued by manufacturers several months ago, the trade is well stocked in porcelain. It is not moving rapidly.

BOSTON

Jobbers report a fair volume of business this week, with a tendency toward less general trade. Government orders occupy the center of the stage and show no signs of diminution. The boom in shipbuilding is reflected in electrical sales along the coast. Collections are still slower than normal, and the use of trade acceptances is being discussed here and there, though as yet little appears to have been done toward their actual adoption. Credit men among the jobbers are making a study of trade acceptances, and some educational work is being done to acquaint jobbing-house salesmen with their principles and practice. Jobbers are carrying rather large stocks at present and are well prepared in most lines for the spring trade. The recent extremely cold weather resulted in another spurt in electric radiator sales. There is little improvement as yet in the New England coal situation, but the prospect for large shipments arriving by water at Boston this week was better than for some time. With New England more than 7,000,000 tons short, more or less industrial curtailment must be expected during the rest of the winter.

WASHING MACHINES.—Increasing interest on the part of the public is reported. While spectacular sales are absent, these machines are steadily coming into favor, and demonstrations by central-station solicitors and supply houses are yielding good results.

ELECTRIC RADIATORS.—These are among the season's "best sellers." One Boston jobber imported 1500 heaters just prior to the recent sub-zero weather and sold all but thirty in a week. Price advances earlier in the winter do not appear to have curtailed sales. These devices have been a godsend to New England in the period of coal famine.

LAMPS.—The situation is constantly improving. At present there is a heavy government demand for carbon incandescents for emergency work, because the supply of tungstens is low. A prominent manufacturer says that factory stocks are not accumulating much, except in "unpopular" sizes. Late price advances appear to have had little effect on the volume of business.

MOTORS.—Stocks are improving in sizes up to 15 hp.; in fact, something like normal conditions can be seen approaching in the small-motor market. No price changes are noted. About 80 per cent of the motor orders now placed are for alternating-current equipment. Motors of 50 hp. and over are still very scarce, and government demands continue unabated and beyond the capabilities of the manufacturer for prompt delivery.

MOLDED INSULATION.—Increasing difficulties in obtaining raw materials are noted at the factory, and the Monday shutdowns combined with railroad embargoes are hampering deliveries. Factory stocks are low. Price tendencies are upward, because of labor shortage.

ATLANTA

The Southeast is enjoying warmer weather this week, and a spirit of optimism prevails. The rising temperature will facilitate the railroads in moving quantities of freight that has been accumulating during the cold weather and which has been sidetracked for fuel movement. Some large shipments of electrical goods are being received by manufacturers and jobbers, which is evidence of the fact that good has come out of the fuel order. The rail embargoes and congestion in the East are being felt here, but on the whole goods are moving fairly well in this section.

Current opinion is that 1918 will be even better than 1917. It is true that 1917 sales were swelled by cantonment construction in the South, but the fact must not be overlooked that the government is just beginning to establish shipbuilding yards at the Southeastern ports. Jobbers already report good business from these centers, which may be considered as only a starter. The Foundation Company, Savannah, Ga., has just received an order for thirty-six mine sweepers. While the coastal cities will boom, a great deal of governmental activity will be felt inland also.

The wood distillates industry is coming along very fast and several plants are projected in Tennessee, two being at

Kingsport and one at Collinwood. These plants are capitalized for approximately $4,000,000. It is also reported that a large amount will be expended in the phosphate business near Centerville, Tenn.

From figures available at this time the sale of wiring devices and small miscellaneous supplies in the Southeast showed a gain of approximately 60 per cent over 1916, and 2300-volt distributing transformers a gain of about 35 per cent.

CONDUIT.—Reports received from manufacturers indicate that a few factories are catching up on their stocks. Stock shipment has been promised from these sources, deliveries, of course, depending on transportation conditions. Although there is no evidence of a general reduction in price, favored purchasers and distributers can secure conduit at prices slightly shading the market from manufacturers whose stocks are accumulating.

PANELBOARDS AND CABINETS.—Manufacturers and jobbers report that business in this line is excellent. The government demand in the Southeast for this class of goods has been very heavy, which has tended to slow up deliveries somewhat.

SWITCHBOARDS.—Business in the smaller distribution type shows a marked improvement. Prices are steady, but deliveries are slowing up.

ARMORED CABLE.—The demand has lessened lately owing to a temporary decrease in apartment-house construction and old-house wiring. Local stocks are in good shape.

SEATTLE

The second week of the month finds wholesalers and retailers enjoying a continuation of satisfactory volume in practically all lines. The outstanding feature of the week's business was an increasing sale of sewing machines. The largest jobber in Seattle reports machines are going like wildfire with no evidence of a let-up, and the demand is being met. Other appliances, with the exception of ranges, are moving very satisfactorily. Range sales are expected to increase materially within the next thirty days. Sales to shipyards and industrial plants are much heavier than in the past three weeks, and transactions with lumber and logging companies are showing renewed activity. Jobbers in the large Northwest cities report many inquiries for motors and electrical equipment for numerous proposed bulk grain elevators for eastern Washington and for Oregon.

The contract for 500,000 incandescent lamps for the Seattle lighting department was awarded to a Seattle firm. The residence building boom in Seattle and Tacoma is continuing unabated. Portland's housing problem has been taken up, and immediate steps are projected to remedy the situation. Lumber production for the week was approximately 21 per cent below normal. Production was 14 per cent above orders and 5 per cent below shipments. Northwest lumbermen assure the government that the maximum output of spruce for airplanes will be reached, starting March 1. The required minimum will be exceeded two or three times. Rural trade in the Middle West promises to be the chief source of private lumber orders this spring, according to present indications. The reported basic eight-hour day is highly objectionable to Northwest lumbermen, and is not to be imposed upon the industry, provided that lumbermen can produce sufficient spruce and fir for government needs in airplane and ship construction.

The immediate appointment by the United States Shipping Board of a district purchasing agent, with headquarters in Seattle, is foreshadowed.

Local jobbing houses report that the freight situation is more distressing than ever, if possible. The free time for intercity switching is cut from forty-eight to twenty-four hours, causing additional grief. Oregon jobbers report the situation considerably improved, although shipments are slow.

Camp Lewis army officials announce the immediate erection of a five-hundred-thousand-dollar hotel. The concession is let to Tacoma capitalists. Lamps are steadily increasing in demand from shipyards, mills and industrials and to care for new residences and remodeling of dwellings. Floodlamp sales are decreasing perceptibly. In flashlamps the demand is sustained.

While jobbers are contending with shortages and slow, irregular deliveries, they are meeting the demand better than could be expected. Conduit jobbers are experiencing difficulties in meeting heavy demands, with stocks in very poor condition. Slow deliveries and increasing demand are causing justifiable uneasiness. During the week the government buying was lighter, although sales to the yards and industrials increased.

The electric heater movement at present is very light. If the present favorable weather prevails, sales will be negligible. Dealers report that the season's sales set a record and were very satisfactory. Dealers' stocks of house-furnishing material are going rapidly and jobbers are feeling the impetus on account of increasing residence building, particularly in Seattle and Tacoma. This applies to sales of chandeliers, sockets, switches and glassware. Collections are easy. New applications for credit are scarce. Amply financed concerns encounter little difficulty in obtaining credit. Jobbers refuse absolutely to take chances and finance prospects.

SAN FRANCISCO

A rainfall that was general all along the Pacific Coast has brought invaluable relief to California farmers. If this is followed up by heavy rains in late February and March, business conditions will improve very materially. The precipitation in the mountains, however, has not been enough to relieve the shortage of stored water for power purposes and hydroelectric companies are still facing a most serious situation.

The wide separation between California and Eastern centers, both as to distance and conditions under which business is carried on, is emphasized by the fact that the "heatless Monday" order, which is not effective in California, is not even felt there as a reflex action from Eastern shutdowns. The one notable effect is the co-operation of power companies in combining transmission systems to save fuel.

The action at Washington in discouraging building will have little effect in San Francisco, since actual building in the month of January was only about 30 per cent of the normal volume. On the other hand, a very material improvement in building conditions has been indicated by the large number of recent inquiries at the Bureau of Buildings, and the possibility of interfering with that has brought out adverse comment on the Washington view.

An aviation camp is to be built at Riverside, Cal., it is announced, which will call for some large orders for electrical supplies. Government construction at other points is also active, and the volume of trade in government work, already very large, is still increasing. Shipbuilding activity is steadily increasing. The latest announcement in this line is that contracts for several more concrete steamers have been awarded. The first of this type is to be launched in a few weeks at San Francisco. Several I. W. W. plots have been prevented in the last week, and aside from the activities of that organization, which are now being effectively checked, labor conditions are in better shape than they have been for some time.

INTERPHONES.—A falling off of apartment-house construction and the tendency to classify interphones among the non-essentials in many buildings have kept this line inactive. There was no accumulation of business in the line during the time the production of interphones was practically discontinued because of the rush of government business.

ELECTRIC RANGES.—The lack of stored water this year, the price of fuel and conditions generally, which have caused sweeping reductions in the sales forces of various California companies, indicate that this will be a poor season for electric ranges of the household type. However, the same fuel and economy problems which hold back this line give impetus to the hotel-type ranges, and that line is very active, with bright prospects Further announcement of the plans of the new consolidation of range manufacturers is awaited with much interest.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to $61.00
Coil to 1000 ft	10% to 59.17
	No. 12 Solid
Less than coil	List to $71.00
Coil to 1000 ft	—10% to 68.87

Twin-Conductor

	No. 14 Solid
Less than coil	List to $105.00
Coil to 1000 ft	$70.00 to 10%
	No. 12 Solid
Less than coil	List to $135
Coil to 1000 ft	10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List to +20%
Coil to 1000 ft	—10% to 5%
	No. 12 Solid
Less than coil	List + 20%
Coil to 1000 ft	—10% to 5%

Twin-Conductor

	No. 14 Solid
Less than coil	List to $115
Coil to 1000 ft	—10% to $80
	No. 12 Solid
Less than coil	List to + 20%
Coil to 1000 ft	—10% to 5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to $24.00
1/5 to std. pkg.	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	20% to list
Std. pkg.	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	18.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	Net to $75.00	—15% to $69.75
3/8-in. d. stp.	+10% to 75.00	List to 72.00
1/2-in. s. stp.	List to 100.00	—15% to 93.00
1/2-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.25-78.75	71.25-71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$25.00-$55.00	$20.50-$24.50	$20.00-$21.50
1/4-in.—	$28.00-$60.00	$22.50-$27.00	$20.00-$23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.00-$55.00	$25.00-$37.50	$22.50-$24.75
1/4-in.—	$40.00-$60.00	$27.00-$30.00	$25.00-$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	1.3% to 4.7%	4.3% to 7.7%
2500-5000 lb.	3.3% to 6.7%	6.3% to 9.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$24.90 to $31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $35.60
Coil to 1000 ft.	21.50 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.75 to $24.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%-37%	20%-32%
$10.00 to $50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000 5½ N. C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to $11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to $23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	14% to $25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	—10% to 11%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	—5% to +5%
$10 to $25 list	—16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	Net
$2.00 to $10.00 list	10% to 20%	5%
$10.00 to $50.00 list	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15% to 20%
$2.00 to $10.00 list	25% to 35%	20%
$10.00 to $50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$4.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼
No. 18, full spools	0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.65
No. 18, full spools	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00	$10.25-$11.50
12	23.25- 25.41	21.30- 21.78	15.97- 19.35
10	32.40- 35.21	29.70- 30.18	22.13- 27.00
8	45.70- 49.12	41.90- 42.12	30.88- 38.00
6	72.40- 77.84	66.35- 66.72	48.93- 60.30

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00	$13.00-$13.50	$11.50-$12.00
12	25.33-$26.28	22.48- 27.02	18.35- 20.93
10	30.48- 36.54	27.94- 31.26	27.86- 29.23
8	47.54- 51.57	38.99- 44.13	31.90- 41.36
6	66.46- 88.38	56.15- 71.61	50.53- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $35.25
25 to 50 lb.	31.25 .....
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$35.50 to $40.35
25 to 50 lb.	34.50 to 39.35
50 to 100 lb.	33.50 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Medium-Base, Brass-Covered Receptacle

A medium-base, brass-covered receptacle is being offered to the trade by Pass & Seymour, Inc., of Solvay, N. Y., this receptacle to be known as P. & S. 60,020. Its shell or cover is in one piece and is made especially rigid by an addi-

PORCELAIN FOUNDATION CAST IN ONE PIECE

tional bead which is spun on the skirt of the cover.

The shell proper of this device is threaded to receive the standard types of the "Uno" shade holder. The brass shell or cover is anchored to the porcelain interior by means of twin screws, and these in turn are held in place by means of special washers. The porcelain foundation for the interior is cast in one piece, and on this the keyless interior is mounted—providing the freedom of accessibility and wiring room so much desired by the practical wireman.

The supporting screw holes for this device are spaced 1⅝ in. and 2 in. (4.1 cm. and 5.08 cm.) on center. The holes for introducing the wires from the back of this receptacle are of ample size to accommodate heavy wires, and the terminal screws will be found of sufficient size and strength to grip and hold the wires. The lamp-screw shell is of special copper alloy and is secured to the porcelain base by a heavy horseshoe reinforcement.

Master Switch

The Igranic Electric Company, Ltd., of London, Eng., has developed the mas-

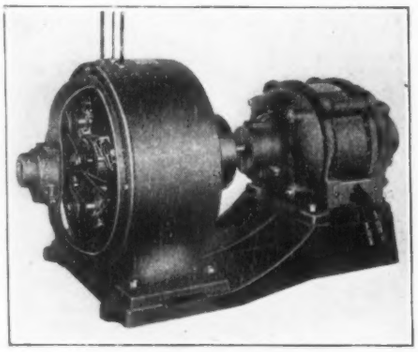
BUTTON FOR STARTING AND LEVER FOR STOPPING

ter switch shown herewith. This switch has a countersunk push-button at the side for starting and a lever at the front for stopping. This type is much favored by those who consider that it is more safe to have starting and stopping devices of dissimilar shape than to have buttons which are distinguishable from each other only by the marking.

Series Type A.-C. to D.-C. "Compensarc"

The General Electric Company, Schenectady, N. Y., has recently developed an a.-c. to d.-c. "Compensarc" equipment which permits series operation of two arc-type projection lamps while projection is being changed from one lamp to the other. This "Compensarc" is known as the series type. It is made in capacities of 35, 50 and 70 amp. for all standard alternating-current circuits and can be used in nearly all installations.

Series operation was desirable to simplify wiring and to save energy by eliminating the steadying resistance in series with each arc lamp that was found necessary with previous methods



PERMITS SERIES OPERATION OF TWO PROJECTION MACHINES

where lamps were connected in parallel across the generator armature. Complete equipment includes the "Compensarc," a steel cabinet control panel and a short-circuiting switch for each projection lamp. The 50-amp. and 70-amp. outfits have in addition a starting compensator. The control panel has an ammeter and a generator field rheostat, which are inclosed in the cabinet. The handle of the field rheostat comes through the panel just beneath the ammeter where it is convenient to regulate the arc-lamp current.

The ammeter, the field rheostat and all the wiring are mounted on the front wall of the cabinet, which is removable for mounting and for attention. Wiring may be either at the top or the bottom, as knock-outs are provided. Simple control is attained through the elimination of steadying resistance, use of few parts and compact arrangement.

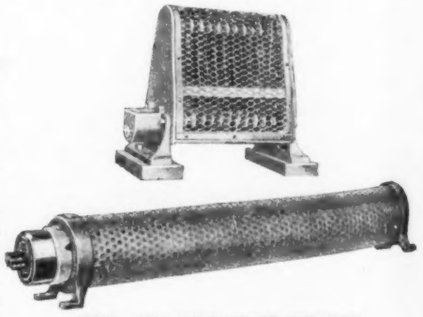
Time Switch

The Hartford Time Switch Company, 71-73 Murray Street, New York City, is bringing out a new type of time switch in order to meet the government requirements of lightless nights. This switch is so designed that after the present emergency has passed it can be readily changed over and become a switch operating each day. These switches are made in sizes ranging from 10 amp. to 200 amp. They are single, double and triple pole and are declared to be dust-proof and weather-proof.

Electric Air Heaters

The Cutler-Hammer Manufacturing Company of Milwaukee has developed and is now marketing a line of electric air heaters designed to supplement the furnace or steam-heating system in the home, office, store, factory or large industrial plant. These electric air heaters are found useful in heating crane cabs, outhouses, valve, pump and meter houses, exposed remote corners or rooms, watch or signal towers, for shearmen and tablemen in steel plants, in theater ticket booths, as well as for scores of miscellaneous applications, and in such uses they effect a distinct saving in coal. Flexible electrical conductors will carry heat cheaply and efficiently to the most inaccessible points.

These air heaters are self-contained, easily moved from one point to another and possess the inherent advantages of all electrical heating devices—heat under perfect control and absolute freedom from dust, ashes, soot, unpleasant odors and vitiation of the air. The perfect control possible allows efficient use of the heat. As soon as a location is warmed, a turn of the switch cuts



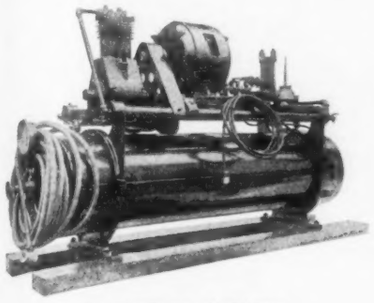
GRID AND UNIT TYPE HEATER

off the current and the heater can be moved to warm another part.

C-H heaters are made in various shapes, sizes and capacities, and a heater to fit almost any space or condition of mounting may be selected.

Automatic Air-Pressure Outfit

The M. L. Bastian Auto Engineering Works, Olney, Philadelphia, has developed the outfit shown herewith, for service in garages and other places



FOR USE IN GARAGES

where air is required. The outfit contains a pump, motor, storage tank, pressure gage and the necessary air and electrical connectors.

The pump is gear-connected to a ½-hp. Robbins & Myers motor which is equipped with a cord and plug for connection to a lamp socket. A rawhide pinion is provided on the motor shaft to eliminate unnecessary gear noise.

Floor-Polishing Machine

The Dale-Rey Corporation of 25 Church Street, New York City, has developed the polishing machine for waxed floors, of wood or linoleum, shown in the accompanying illustration. It is pointed out that this machine is easy to operate; a boy or woman can easily handle it and quickly obtain a uniform result. The outfit weighs approximately 100 lb. (45.4 kg.). Its height over the case is 9½ in. (24.1 cm.), and the width is 19 in. (48.3 cm.). It is mounted upon rollers, and moves around with little effort. It will go under desks—an important feature, it is pointed out.

CAN ALSO BE USED FOR SCRUBBING FLOORS

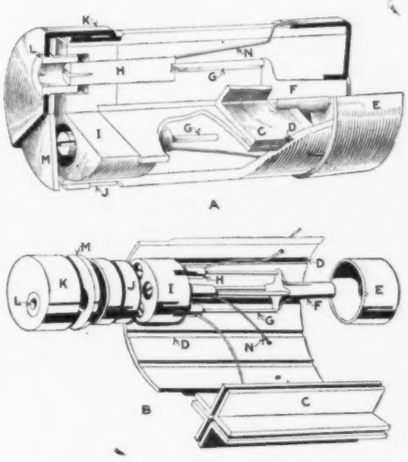
The essential apparatus consists of a cylindrical brush, propelled by a ¼-hp. motor. The brush revolves at high speed, and not in the same plane as the floor, but at right angles thereto. This buffing action produces a hard surface —resulting in a reduction in the amount of wax required.

The brush is made up of two semicircular aluminum cylinders, mounted upon an aluminum drum, running upon Hess-Bright ball bearings, and is propelled from the motor by a chain and sprocket. A counterbalanced weight upon the handle of the machine may be adjusted so as to alter the pressure upon the floor.

Four-in-One Cartridge Fuse

A four-in-one cartridge fuse, known as the Atlas fuse, has been placed on the market by the Atlas Selling Agency of New York City. A sectional view *A* and an exploded view *B* of this fuse are given in the accompanying figure.

From the outside this type of fuse looks the same as the standard type of cartridge fuse, and it can be used anywhere that standard fuses are used. However, instead of one single chamber, as in the ordinary type of cartridge fuse, the inside of the shell is divided into four compartments by four pieces of fiber, then bent and assembled, as shown at *C* in both views. The fiber compartments fit into grooves *D* in the fiber-containing shell, making a strong construction.



SECTIONAL AND EXPLODED VIEW OF FUSE

One end of the fuse shell is equipped with a stationary brass cap *E*. From the center of this stationary cap is a copper extension *F*, from which four fuse wires *G* run through the four separate compartments to four copper terminals *H*, held in a short shell fiber cylinder *I* at the opposite end of the fuse. A stationary brass ferrule *J* is placed on the end of the fuse shell containing the four fiber terminals *H* and fiber cylinder *I*. Fitted over the stationary ferrule is a movable brass cap *K* containing a copper receptacle *L* that fits over one of the copper fuse terminals *H*, as shown in the sectional view. This completes the circuit through the fuse from the movable cap *K* to the stationary cap *E*. The copper terminals *H* are slotted in the end that the receptacles fit over, to give them a spring and make a good contact in the receptacle.

If a fuse blows, all that is necessary is to remove the cartridge from the clips, pull cap *K* out about ¼ in. (6.4 mm.), and give it a quarter turn, push back the cap, and another fuse element is in circuit. Replace the cartridge in the clips, and the circuit is again ready for service. To prevent making contact with any fuse element other than the one that is intended to be in circuit, a fiber washer *M* is placed in the top of the movable cap *K*. The blowing of a fuse element is indicated, as in a standard fuse, by a fine steel wire *N* that extends from the copper terminal *H* to the stationary cap *E*. Each fuse element is solidly packed in its chamber with an insulating powder. This new type of fuse is approved by the Underwriters' Laboratories, and is made with ferrule contact in all amperages up to and including 60. All measurements and dimensions are N. E. C. standard, thus assuring perfect fit in every type of N. E. C. standard panel, switchboard and inclosed-fuse cutoff.

Sign and Outlet Receptacle

Pass & Seymour, Inc., of Solvay, N. Y., are about to place on the market a receptacle that will be known to the trade as their No. 437. This device is of the screw-ring type which fits the common 1½-in. (3.8-cm.) hole. Its principal advantage lies in the fact that the body of the receptacle proper is but 13/16 in. (2.06 cm.) in depth. This allows the wires to be carried the proper distance from the surface wired over and effects a material economy of space because it does not extend back far from the face of the sign, and when used in outlet boxes it does not extend from the outlet-box cover as far in the box as the common receptacle.

Provision is made in the back for pouring weatherproofing compound, thereby entirely covering the metal parts. It is also pointed out by the manufacturer that the receiving shell for the lamp is very rich in copper and yet has sufficient alloy to render it a dependable and rigid member. This lamp shell is retained in the receptacle by means of phosphor-bronze screws of special strength, which readily permit the removal of the receiving shell for the lamp without disturbing the terminal plates in the back of the receptacle.

A ball-tipped spring-center contact of phosphor bronze guarantees continuous contact with the base of the lamp. This is an important item because the usual

METAL PARTS ARE ENTIRELY COVERED

location of these receptacles, when installed, is remote and hard to get at. Any feature which adds to the durability and permanency of the device, it is pointed out, makes frequent attention unnecessary.

Trade Notes

THE GILPIN V. C. COMPANY, formerly of 2010 Broadway, has removed its offices to the warehouse at 50 Columbia Heights, Brooklyn, N. Y.

J. W. TABB has been transferred to the New York City office of the Western Electric Company. He was formerly manager of the San Francisco branch of that company.

LYMAN C. REED, 821 Union Street, New Orleans, La., has been appointed district sales agent for the alternating-current motors and fans of the Century Electric Company, St. Louis.

C. M. SCOTT, formerly Cleveland representative of the Detroit Fuse & Manufacturing Company, is now associated with the Western Electric Company and will continue to make Cleveland his headquarters.

THE AJAX ELECTRIC COMPANY, recently incorporated in Jersey City, N. J., has acquired property at Montgomery Street and Baldwin Avenue, about 95 ft. by 100 ft., for the manufacture of electric generating machinery.

LEO H. GAMP, formerly manager of the F. E. Newbery Electric Company, announces that he has organized the Gamp Electric Company, with offices at 1625-26 Chemical Building, St. Louis, Mo., for the purpose of doing a general electrical construction business.

E. I. WILLIAMS, recently with the Canadian General Electric Company, has been engaged by the Estate Stove Company of Hamilton, Ohio, as a representative of its electrical department. Mr. Williams has been identified with the electric heating industry for many years.

FRED WILMARTH of Rockford, Ill., has been selected to represent the Greusel-Quanfot Electric Company of Milwaukee, Wis., in northern Illinois and southern Wisconsin. Mr. Wilmarth has just completed a long service with the firm of E. F. Pendergast & Company of Rockford.

THE COOPER HEWITT ELECTRIC COMPANY of Hoboken, N. J., announces that its Cincinnati office has been moved into larger quarters at No. 1406 First National Bank Building. George W. Walker, who has been with the company for the last ten years, continues as district sales manager.

THE INDEPENDENT LAMP & WIRE COMPANY has transferred its automobile and miniature lamp business to the Miniature Incandescent Lamp Corporation of Newark, N. J., where the production will be increased to approximately 30,000 lamps per day, enabling the company to take care of the greatly increased demand for its products.

JAMES B. OLSON has resigned as assistant secretary and general sales manager of the Habirshaw Electric Cable Company, Inc., of New York City. Mr. Olson expects to continue in the insulated wire and cable business, resuming business relations in the near future. In the meantime his address will be Hotel Chatelaine, Bedford Avenue, Brooklyn, N. Y.

THE GROSSMAN MANUFACTURING CORPORATION, Brooklyn, N. Y., announces that while the government has taken over the Bush Terminal property in Brooklyn, this will not affect its business. The government has only requisitioned the Bush docks and warehouse buildings, which does not in any way affect the industrial building in which the Grossman company is established.

H. W. WISWELL, recently manager of the apparatus department of the Brown & Hall Supply Company, St. Louis, and formerly with the St. Louis sales office of the Westinghouse Electric & Manufacturing Company for about ten years, has gone into business, under the style of H. W. Wiswell Company, as manufacturers' sales specialist, handling motors, generators, transformers, meters, electrical equipment and supplies.

ROBERT S. PARRETT of Alexandria, Va., has been appointed commercial attaché to the American embassy at Buenos Aires, Argentina, according to an announcement made Feb. 7 by the Bureau of Foreign and Domestic Commerce, Department of Commerce. He will also act as the War Trade Board's representative in Argentina. The commercial attachés are "business diplomats" stationed permanently at the principal foreign capitals. Their work is particularly important at this time, when careful attention must be given to present abnormal conditions and plans laid for maintaining the position of the United States after the war.

JOHN F. GILCHRIST has been elected president of the Federal Sign System (Electric), succeeding John H. Goehst, who died on Jan. 1, 1918. Mr. Gilchrist was one of the organizers of the Federal Electric Company, predecessor of the Federal Sign System (Electric), and served as treasurer for a number of years. Mr. Gilchrist is also vice-president of the Commonwealth Edison Company, vice-president of the Middle West Utilities Company, and assistant to the president of the Public Service Company of Northern Illinois. James M. Gilchrist has been elected secretary and treasurer of the Federal Sign System (Electric), succeeding as treasurer John F. Gilchrist, and Ralph T. Schuettge has been elected a director to succeed Mr. Goehst.

THE HURLEY MACHINE COMPANY of Chicago is offering for investment $500,000 of 7 per cent cumulative preferred stock, par value $100 per share. It is redeemable at $110 and accrued dividends, carrying with it 15 per cent in common stock. The Hurley company manufactures a large line of electrical labor-saving devices for the home, under the trade name "Thor." Through this new capital the company will be provided with facilities to increase its output from 400 to 600 per cent over its 1917 sales, which totaled about $1,680,000. The new plant of the company, which it purchased early in the year, at Twenty-second Street and Fifty-fourth Avenue (Cicero), just outside the city limits, is 256 ft. by 636 ft., the buildings containing 65,000 sq. ft. of floor space.

THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE, Department of Commerce, Washington, D. C., in a report made public lately, points out America's opportunity of increasing its sales of electrical goods in Ecuador and Peru during the absence of German competition. Before the war this trade was divided between Germany and the United States, the advantage being with the American manufacturer. The government's report is concerned with the market as it exists to-day and the opportunities it offers for the future. Copies of "Electrical Goods in Ecuador and Peru," Special Agents' Series No. 154, can be purchased, at the nominal price of 10 cents, from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from any of the district or cooperative offices of the Bureau of Foreign and Domestic Commerce.

EXPORT LICENSES.—The War Trade Board has announced that all export licenses issued on and after Jan. 22, 1918, shall be valid for a period of ninety days except in the case of special commodities where a different period is specifically prescribed or allowed. Heretofore the term of an ordinary export license has been sixty days from the date of issuance, and the new ruling has been adopted in order to aid manufacturers who contract for future delivery and to avoid congestion at ports of exit due to the expiration of export licenses pending shipment and the delay involved in obtaining new licenses or extensions of the originals. No extensions whatsoever of the new "ninety-day" licenses will be granted. If it becomes evident that goods cannot be shipped during the term of the license, a new application for license should be filed in ample time stating the probable date of shipment. In such cases the original license should not be returned with the new application but should be held until it has expired. Extensions of licenses issued on or before Jan. 21, 1918, will be granted as heretofore. It is announced that the Bureau of Exports has discretion to grant licenses valid for a period not exceeding six months in cases where the article to be exported must be specially manufactured and there is satisfactory evidence that more than ninety days are required for its manufacture and shipment. No extensions whatsoever of these licenses will be granted, and in case of expiration before shipment a new license must be applied for.

Trade Publications

FANS.—The Eck Dynamo & Motor Company of Belleville, N. J., has prepared a leaflet descriptive of its Eck hurricane fans.

PIPE BENDER.—The Martin portable vise stand and pipe bender is illustrated and described in a leaflet prepared by H. P. Martin & Sons, Owensboro, Ky.

SYNCHRONOUS MOTORS.—Bulletin No. 182, descriptive of synchronous motors, has been prepared by the Electric Machinery Company of Minneapolis, Minn.

PIPE VISE.—The Gerolo Manufacturing Company of Old Colony Building, Chicago, is distributing a leaflet descriptive of its Chaingrip pipe vise.

AMMONIA CONDENSERS.—The De La Vergne Machine Company of New York City has prepared a folder descriptive of its counter-current ammonia condensers.

FANS.—The Racine Electric Company of Racine, Wis., is distributing a leaflet descriptive of its 12-in. desk and wall fan, its 8-in. desk and wall fan and its table fan.

LIGHTING FIXTURES.—The Luminous Unit Company of St. Louis, Mo., is distributing its catalog No. 6, descriptive of its "Brascolite," "Aglite," "Projectolite" and "Industrolite" units.

STREET-LIGHTING FIXTURES.—Type CL Luxeolite fixtures are illustrated and described in catalog 7-A, supplement 3, issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

PROJECTOR DEVICES.—The Argus Lamp & Appliance Company, 322 Euclid Avenue, Cleveland, Ohio, is distributing a booklet of sales information and prices, in effect Feb. 1, 1918, covering Argus units, consisting of the Sheck universal adapter and Argus current regulators, for operating all types of Mazda projector lamps for motion-picture projection.

STOKER EQUIPMENT.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing a folder containing leaflets on its stoker equipment. The subjects taken up in these leaflets are cost of steam, the Westinghouse Roney stoker applied to tubular boilers, air distribution of underfeed stokers, efficiency and capacity of underfeed stokers and the construction of underfeed stokers.

ILLUMINATION.—In a bulletin entitled "Fundamentals of Illumination Design" the engineering department of the National Lamp Works of General Electric Company has presented in simple and readable language a discussion of the broad principles which underlie illuminating engineering practice. The bulletin should prove of exceptional value to schools and colleges, particularly to those in which a course in illumination is included as a part of the regular study program. Its value is not limited to students, however, for much of the material presented is the result of very recent investigations and the data will bear the closest scrutiny of the practicing illuminating engineer. This bulletin on the fundamentals, the bulletins on specific applications, such as industrial lighting, store lighting, show-window lighting, light projection, tennis-court lighting, protective lighting, etc., together with the bulletins on Mazda lamps, comprise an accurate, practical and up-to-the-minute reference work on illumination.

New Incorporations

THE OSBORNE STORAGE BATTERY COMPANY of Cleveland, Ohio, has been chartered with a capital stock of $10,000 by Carroll K. Osborne and Earl H. Jaynes.

THE SPENMAN ELECTRIC VALVE GRINDING COMPANY of Worcester, Mass., has been incorporated with a capital stock of $50,000 by B. T. Spenman, A. W. Larson and J. N. Sandberg, all of Worcester.

THE TECHNICAL PRODUCTION COMPANY of New York, N. Y., has been incorporated by G. H. Hyman, J. Lampel and H. Lampel, 580 Fifth Avenue, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture electrical supplies.

THE STORAGE BATTERY DISTRIBUTING COMPANY, 678 Montgomery Street, Jersey City, N. J., has been incorporated by Frederick S. Moore, 258 Springfield Avenue, Newark, N. J.; Howard C. Chase, 2560 Boulevard, Jersey City, and John H. Bauer, 48 Bergen Avenue, Jersey City. The company is capitalized at $6,500 and proposes to equip and deal in electrically-propelled and other vehicles.

THE PAGE WIRE FENCE COMPANY OF CANADA, of Walkerville, Ont., has been incorporated with a capital stock of $250,000 to manufacture iron, steel, metals, hot and cold ingots, billets, rods, bars, wire, cable, etc. Arrangements are being made by the company to erect a plant at Three Rivers, Que., to cost about $150,000. The incorporators are: Arthur R. W. Plimsoll, Reigner Brodeur, Adolphe Chouinard and others of Montreal, Que.

THE ALMA (MICH.) ELECTRIC & BATTERY COMPANY has been incorporated with a capital stock of $20,000.

THE MAJESTIC ELECTRIC SUPPLIES, Ltd., of Toronto, Ont., Can., has been chartered with a capital stock of $150,000 by Jacob H. Greenberg, 24 King Street West, Toronto, and others.

THE McDANIEL ELECTRIC COMPANY of Mansfield, Ohio, has been incorporated with a capital stock of $10,000 by William McDaniels, Roy J. McDaniel, F. Frank, E. McDaniel and William F. Gill.

THE UNITED STATES MAGNETO COMPANY of New York, N. Y., has been incorporated with a capital stock of $10,000 by C. R. Allison, J. J. McGrath and A. L. Story, 128 Broadway, New York, N. Y.

THE MARVIS MACHINERY COMPANY of New York, N. Y., has been chartered by Arthur P. Davis, David M. Mahood and John H. Noll. The company is capitalized at $10,000 and proposes to do electrical work.

THE APPEL BATTERY SERVICE COMPANY of St. Louis, Mo., has been chartered with a capital stock of $6,000 by Victor R. Appel, Robert G. McCurdy and Harry W. Pohle. The company proposes to deal in auto storage batteries.

THE AKRON (OHIO) ELECTRIC REGULATOR COMPANY has been incorporated with a capital stock of $100,000 by William H. K. Stephens, H. K. Raymond, William F. Pfeiffer, C. W. McLaughlin, W. Franklin Clark and John W. Thomas.

THE NEW YORK ELECTRICAL LABORATORIES of New York, N. Y., have filed articles of incorporation with a capital stock of $10,000. The incorporators are: F. C. Hoops, T. B. Hazleton and S. Morgan, 47 West 125th Street, New York, N. Y.

THE CHINA ELECTRIC COMPANY of Dover, Del., has filed articles of incorporation with a capital stock of $1,000,000 to construct and operate electric plants. The incorporators are : W. F. O'Keefe, G. G. Speighler and E. E. Wright of Wilmington, Del.

ALBERT F. GANZ of New York, N. Y., has filed articles of incorporation with a capital stock of $12,000 to manufacture apparatus for the mitigation of electrolysis, etc. The incorporators are: E. L. Hegeman, R. J. Jacobus and F. L. R. Francisco, 511 Fifth Avenue, New York, N. Y.

THE ELECTRIC COMPANY of Hartford, Conn., has been incorporated by George H. Cooper, J. G. Peterson, both of Hartford, and Theodore Birath of Jersey City, N. J. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical devices, etc. The company will begin business with $3,500.

THE SCHROEDER HEADLIGHT & GENERATOR COMPANY of Evansville, Ind., has been chartered with a capital stock of $150,000 by William H. McCurdy, John D. Craft, William A. Carson, Albert F. Karges, Marcus S. Sonntag, J. H. Schroeder and S. W. Cook. The company proposes to manufacture and deal in headlights.

THE ELECTRIC WELDING & MANUFACTURING COMPANY of Milwaukee, Wis., has been chartered with a capital stock of $10,000 by George F. Luehring, Joseph Stika and Oscar Greulich. The company proposes to operate a machine shop and specialize in repairs by the oxy-acetylene process, as well as manufacture seamless goods.

THE EQUITABLE MACHINERY CORPORATION of New York, N. Y., has been incorporated by C. E. McManus, 400 West 160th Street; T. F. Hussa, 50 Church Street, New York, N. Y., and C. W. Hussa of Montclair, N. J. The company is capitalized at $25,000 and proposes to manufacture engines, electric supplies and mechanical apparatus.

THE ARMA ENGINEERING COMPANY of New York, N. Y., has been chartered with a capital stock of $50,000 by A. P. Davis, 542 West 112th Street; P. C. Werner, 202 Riverside Drive, New York City, and D. M. Mahood, 4821 Fort Hamilton Parkway, Brooklyn, N. Y. The company proposes to do a general electrical and mechanical engineering and general contracting business, etc.

New England States

BOOTHBAY HARBOR, ME.—The property and holdings of the Boothbay Harbor Electric Light & Power Company have been taken over by the Lincoln County Power Company, which plans to enlarge the plant. Contracts for the construction of a new power station at Boothbay Harbor have been awarded and work is being pushed on the new 11,000-volt transmission line now being erected to connect Damariscotta, Bristol and Boothbay Harbor.

LYNN, MASS.—The Lynn Gas & Electric Company contemplates the installation of a 7500-kw. turbine. Orders have been placed for the machine to be delivered in June. J. F. Dubois is manager of the electric department.

NEW BEDFORD, MASS.—The Board of Gas and Electric Light Commissioners has granted the New Bedford Gas & Electric Company permission to issue 4770 shares of capital stock at $150 a share (par value $100) and also to issue $885,000 in bonds, the proceeds to be used to take up outstanding indebtedness and to pay for the cost of the new Cannon Street station now under construction.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has petitioned the Selectmen of Kingston for permission to erect poles on Brookdale Avenue from the Duxbury town line to Brackett's Mill for the purpose of operating a three-phase, 11,000-volt transmission line.

WORCESTER, MASS.—The City Council is considering the installation of additional street lamps on Fairmont Avenue and on Plantation Street from the Boston and Albany railroad bridge to Franklin Street.

NORWICH, CONN.—Contracts have been signed by the Water and Light Commissioners for one 4000-kw. General Electric turbine, two Babcock & Wilcox boilers (510 hp.), C. H. Wheeler condensing apparatus, two sets of type "E" stokers and forced and induced draft apparatus for the municipal electric-light plant. A new building will be erected for the boilers. S. J. Kehoe is manager of the municipal gas and electric plant.

Middle Atlantic States

ALBANY, N. Y.—A portion of the plant of the Esco Electric Company of Albany was destroyed by fire on Jan. 30, causing a loss of about $75,000.

ALBANY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 27 for conduit and wiring, gas piping and lighting fixtures in the United States custom house and post office at Albany. Specifications may be obtained at the above office or at the office of the custodian at Albany.

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until March 6 for renewals of electric wiring, main building, Binghamton State Hospital, Binghamton. For details see Searchlight Department.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company of Buffalo, which recently took over the Salmon River Power Company, has been authorized by the Public Service Commission to issue $1,300,000 in notes, the proceeds to be used for extensions and improvements and to take up outstanding obligations. The company has begun work on the installation of a 15,000-hp. steam-driven electric generating unit at its Lyons plant.

HUDSON, N. Y.—Work has begun on the new electric power cable to be erected across the river, just below Hudson.

LYONS, N. Y.—The output of the steam electric generating plant of the Niagara, Lockport & Ontario Power Company in Lyons is being increased from 25,000 hp. to 40,000 hp. It is expected to have the new unit installed by June 1, 1918.

OGDENSBURG, N. Y.—The City Council is considering entering into an agreement with the Ogdensburg Power & Light Company to furnish electricity to operate the pumping station. Tentative terms are being considered by the Council for renewing the contract for street-lighting which expires some time next year. Mayor Frank is said to be in favor of extending the cluster-lamp lighting system from Ford Street to the New York Central depot.

SCHENECTADY, N. Y.—A certificate of extension of service has been filed in the office of the county clerk by the Schenectady Illuminating Company, which provides for supplying electricity for lamps and motors and also manufacturing and dealing in all kinds of electrical appliances and apparatus in towns in Schenectady, Albany, Fulton Herkimer, Montgomery, Rensselaer, Schoharie, Saratoga and Washington counties.

UNION SPRINGS, N. Y. — The Union Springs Light & Power Company is erecting 12 miles of electric transmission lines to supply electrical service to the country between Auburn and Union Springs. Energy will be secured from the Niagara Power Company, through the Empire Gas & Electric Company (Auburn division). The line will be completed early in the spring of 1918. The local plant, it is expected, will be closed down when the line is finished. Transmission lines are also being erected to the towns of Flournoy, Mapleton and the summer resort at Farley's, N. Y. Douglas A. B. Smith is general manager.

NEWARK, N. J.—The Gamon Meter Company, 286 South Street, is contemplating the construction of a boiler plant and engine house at its works.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for furnishing under specifications No. 2809 one electric traveling crane at the navy yard, Philadelphia. The cost is estimated at $25,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for furnishing an electrically-operated traveling crane, of the overhead type, installed on the runways in the addition to the boat shop at the navy yard, Philadelphia. Drawings and specifications (No. 2809) may be obtained on application to the above bureau or to the commandant of the navy yard named.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for addition to boat shop, consisting of a new building, 100 ft. by 400 ft., and an extension of existing building, about 62 ft. by 116 ft., including lighting and heating systems, etc. Drawings and specifications (No. 2806) may be obtained on application to the bureau or to the commandant of the navy yard named.

PLYMOUTH, PA.—Plans, it is reported, are being considered by the Amercian Gas Company for rebuilding the electric-light plant of the Luzerne County Gas & Electric Company of Plymouth, which it controls.

SINKING SPRING, PA.—Application will be made to the Public Service Commission by the Berkshire Electric Company of Sinking Spring for approval of a contract with the borough of Wernersville and the borough of Robesonia for street lighting.

BRIDGEVILLE, DEL. — The Eastern Shore Gas & Electric Company is erecting an electric transmission line from Bridgeville to Greenwood to supply electricity to the latter place. When the line is completed the plant at Greenwood will be closed down. The local plant will then supply energy in Laurel, Blades, Seaford, Bridgeville and Greenwood.

CHARLESTON, W. VA.—Extensions and improvements are under way by the West Virginia Water & Electric Company, which will greatly increase the output of both the electric and water plants. The company has recently closed a contract with the United States government to supply water and electricity for lamps and motors at the new government projectile plant now being erected in Charleston. W. C. Davisson is vice-president.

FAIRMONT, W. VA.—The board of directors of the Monongahela Valley Traction Company, it is reported, have approved an issue of $3,000,000 in notes, the proceeds to be used for improvements. The proposed work includes a large power plant at Rivesville, already reported under construction.

WHEELING, W. VA.—The City Council is considering changing the street-lighting system from direct to alternating current. A consulting engineer has been engaged to make investigations relative to same. W. B. Kain is superintendent of the municipal electric-light plant.

WASHINGTON, D. C.—Bids will be received by the general supply committee, Treasury Department, Washington, D. C.,

until March 6 for furnishing as may be ordered from time to time during the fiscal year beginning July 1, 1918, and ending June 30, 1919, supplies as follows: Class 5—Laboratory apparatus and hospital appliances and surgical instruments; Class 6—Electrical, engineering and plumbing supplies; Class 15—Incandescent electric lamps; Class 16—Incandescent gas lamp supplies; Class 17—Motor trucks; Class 18—Machines, office, labor-saving; addressing, computing, duplicating, folding, sealing and typewriting; supplies for addressing machines and typewriter equipment, etc., of the general schedule of supplies for use by the executive departments and other establishments of the government of the United States. Proposal blanks may be obtained on application to the general supply committee, Auditor's Building, Fourteenth and B Streets, S. W., Washington, D. C.

North Central States

DETROIT, MICH.—Bids will be received by the lighthouse inspector, Detroit, Mich., until Feb. 19, for furnishing an 18 to 24-hp. marine gasoline engine. Further information may be obtained at the above office.

FLINT, MICH.—The office building of the Michigan Light Company and the Consumers' Power Company was damaged by fire recently, causing a loss of about $30,000.

FLINT, MICH.—Bids will be received by the Board of Water Commissioners of the city of Flint until March 5 for furnishing and installing one 15,000,000-gal. 150-ft. total head-geared turbine-driven centrifugal pumping unit with condenser and auxiliaries. F. N. Baldwin is superintendent.

MORENCI, MICH.—The Southern Michigan Light & Power Company is planning to extend its electric transmission line, three phase, 6600 volts, to Alverton, Ohio, and Waldron, Mich., work on which will start early this spring. The company will furnish energy to operate the Avis Milling Company at Waldron, which operates a flour mill and lighting plant. C. J. Avis is treasurer.

CLEVELAND, OHIO.—Bonds to the amount of $350,000, it is reported, have been sold by the city of Cleveland, the proceeds to be used for improvements to the municipal electric-light plant.

DAYTON, OHIO.—Arrangements have been made whereby the Dayton Power & Light Company will furnish electricity to be used in the construction work by the Miami Conservancy District. The power will be used on the Germantown, Englewood, Taylorsville and Huffman dams and for river channel excavation in Dayton. The company will begin work at once on the erection of electric transmission lines to the various dam sites. At Dayton two large drag-line excavators, operated by electric motors, will be the principal power users. All motors to be used in the work have been purchased.

NORTONVILLE, KY.—The Norton Coal Mining Company is planning to build an addition to its power house, brick commissary house and supply house, for which bids have been received. B. Price, Empire Building, Birmingham, Ala., is architect.

BRAZIL, IND.—The Terre Haute, Indianapolis & Eastern Traction Company of Indianapolis has filed a petition with the Public Service Commission for authority to purchase the plant and holdings of the West Indiana Utilities Company of Brazil.

MARION, IND.—The capital stock of the Delta Electric Company has been increased from $90,000 to $115,000.

WHITING, IND.—Bids will be received by the Board of Public Works of Whiting, Ind., until Feb. 25 for construction of a sewage pumping system in accordance with plans and specifications now on file at the office of the Board of Public Works.

SALEM, ILL.—Work has begun on rebuilding the local machine shop and engine house of the Chicago & Eastern Railroad Company, recently destroyed by fire. The cost of the new buildings is estimated at about $300,000.

APPLETON, WIS.—The Patton Paper Company, it is reported, is considering the construction of a hydroelectric power plant.

BAYFIELD, WIS.—Preparations are being made by the Booth Fisheries Company of Chicago, Ill., to build a new cold-storage warehouse and refrigerating plant at Bayfield to replace the group of buildings destroyed by fire on Jan. 18, causing a loss of about $50,000.

BLOOMER, WIS.—The transmission line of the Wisconsin-Minnesota Light & Power Company, which supplies energy to the Bloomer Electric Light & Power Company, is being changed from 6600 to 13,200 volts to be delivered at the substation at Bloomer. Three-phase, 220-volt motor circuits will be available upon completion of the line about March 15. The plant may possibly be taken over by the municipality, which is now considering establishing a municipal electric-light and power plant. F. E. Walrath is secretary and manager.

LA FARGE, WIS.—The La Farge Electric Company will install a 125-hp. Corliss engine this year. Machinery has already been purchased.

OWEN, WIS.—The J. S. Owen Lumber Company has been granted a franchise to supply electricity in Withee. The company has taken over the municipal electric plant and will soon supply energy from its local plant to operate the Withee system. A. R. Owen is president.

WITHEE, WIS.—Electricity for operating the local system will be furnished from the plant of the J. S. Owen Lumber Company of Owen, which has been granted a franchise in Withee and taken over the municipal electric plant.

CROOKSTON, MINN.—At an election to be held Feb. 20 the proposal to issue $535,000 in bonds for the purchase of the property of the Crookston Water Works, Power & Light Company will be submitted to the voters.

ELY, MINN.—The Hines Lumber Company, it is reported, contemplates developing the water power at the Kawishiuri Falls to furnish power for mines and other local industries.

LANESBORO, MINN.—Plans have been prepared by the Power Engineering Company, Corn Exchange, Minneapolis, for a municipal hydroelectric plant. The city will build superstructure for power house and, it is said, will call for bids on water wheel, generator and governor. The plant will be changed from direct to alternating-current system. A transformer and transmission supplies will be purchased.

VIRGINIA, MINN.—The contract for electrical work for the high school building has been awarded to the Sterling Electric Company, 33 South Fifth Street, Minneapolis, Minn., at $38,906.

CEDAR FALLS, IOWA.—The city of Cedar Falls is planning to install a 150-hp. horizontal boiler in the water works pumping station.

GREENFIELD, IOWA.—The Council has adopted a resolution authorizing the construction of 6-in. water mains and the erection of a transmission line to supply electricity for pumping water.

SIGOURNEY, IOWA.—The Sigourney Electric Company has applied to the Board of Railroad Commissioners of Iowa for a franchise to construct and operate an electric transmission line on the roads and highways of Keokuk County for the distribution of electricity for lamps and motors.

FAIR PLAY, MO.—Steps have been taken to organize a stock company for the purpose of building a hydroelectric plant on Bear Creek to supply electricity in Fair Play and neighboring towns. The cost of the proposed plant is estimated at $20,000. W. C. Elrod of the Fair Play Roller Mill Company and others are interested in the project.

BRADLEY, S. D.—The Dakota Northern Power Company of Bradley is contemplating erecting 15 miles of electric transmission line to connect its system with transmission systems of the Spink County Power Company, which it controls. The electric plant at Henry has been discontinued and is now being served by the transmission line of the Dakota Northern company. The power station at Raymond has also been closed down and is being served by the Spink County Power Company. E. H. Lewis is secretary and manager.

BROOKINGS, S. D.—Bids will be received by the Regents of Education of the State of South Dakota, addressed to the president of the State College of Agriculture and Mechanic Arts, Brookings, S. D., until Feb. 25 for the electric wiring of the armory building to be erected at the State College of Agriculture and Mechanic Arts, Brookings. F. H. Ellerbe of St. Paul, Minn., is architect.

LESTERVILLE, S. D.—The contract for construction of the proposed municipal electric-light plant has been awarded to Otto S. Oleson of Sioux Falls.

BROKEN BOW, NEB.—Preparations, it is reported, are being made to install a new 100-hp. Loomis engine in the local electric-light plant for the purpose of extending the commercial lighting service.

DUNBAR, NEB.—The new municipal electric-light plant has recently been completed and put into commission.

FALLS CITY, NEB.—At an election held recently the proposal to issue $60,000 in bonds for extensions to the municipal electric-light plant and water-works system was carried.

JUNIATA, NEB.—The City Council is considering calling an election to submit to the voters the proposal to issue $7,000 in bonds for the construction of an electric transmission line to Hastings.

DODGE CITY, KAN.—The Midland Water, Light & Ice Company has petitioned the City Council to submit a proposal to extend its franchise for a period of ten years to the voters. The company is asking for an extension of its franchise to enable it to make improvements in order to maintain electric transmission lines from Dodge City to neighboring towns in the Arkansas River Valley. The request for a 20-year franchise was defeated last fall.

KINGMAN, KAN.—The old millrace and power plant has been purchased by the Independent Milling Company of Kingman, which will utilize the power to generate electricity to operate its mill.

LEAVENWORTH, KAN.—Arrangements have been made by the Victor Manufacturing Company, manufacturer of electric washing machines, to erect a new building and double the output of its plant.

Southern States

JACKSON, GA.—Improvements are contemplated to the municipal electric-light plant, including rebuilding 1½ miles of pole line (2300 volts) and the installation of a high-pressure centrifugal pump, two stage, electrically driven. W. E. Merck is general manager of the water and light plant.

JEFFERSONVILLE, GA.—The Council is considering calling an election to vote on the proposal to issue $15,000 in bonds for the installation of a municipal electric-light plant.

SHELLMAN, GA.—Another well is being installed to furnish water for the boiler in the municipal electric-light plant. E. C. Pemberton is superintendent.

WAUCHULA, FLA.—The Council will soon call an election to submit the proposal to issue $42,000 in bonds to purchase or to build an electric-light plant and for other municipal improvements to the voters.

WHIDDEN, FLA.—The Kissimmee Cattle Company is reported to be considering the installation of an electric-light plant and ice factory. W. E. Ward of Kissimmee is manager. Whidden has not a post office.

BRISTOL, TENN.-VA.—The power dam rwhich was nearing completion for the Rosedale Power Company, on the Holston River, near Bristol, was recently damaged by the flood.

CLINTON, TENN.—The local electric-light plant has been purchased by the Clinton Power Company. The new owners will improve the plant and extend the service. E. C. Cross is president.

COLLINWOOD, TENN.—Contract has been awarded by the Tennessee Valley Iron & Railroad Company to the Thompson-Starrett Company, 51 Wall Street, New York, N. Y., for the construction of a wood distillation plant. The cost of the entire plant is estimated at $1,500,000. Various improvements including construction of dwellings, water supply, electric-lightnig systems, sewers, etc., will cost about $500,000. W. J. Summers of New York City will have charge of the construction work in Collinwood.

FRIENDSHIP, TENN.—The plant and equipment of the Friendship Electric Light & Power Company, it is reported, has been purchased by the Marvel Milling Company. A new generator has been purchased, it is understood, by the Marvel company which will be installed in the Main Street mill.

BIRMINGHAM, ALA.—Plans are under way for the construction of an interurban railway to be operated by electricity or other power from Birmingham to the Warrior River, a distance of about 21 miles. Two routes are under consideration, one of which would necessitate the building of only 16 miles of line, about 5 miles of existing railroad being utilized. The other plan is to construct an entirely independent line. A company to be known as the Alabama Interurban Railway Company, capitalized at $5,000,000, will be incorporated to build and operate the proposed railway. G. R. Harsh is general counsel.

GURLEY, ALA.—The Alabama Power Company is erecting an electric transmission line from Huntsville to Gurley. When completed electricity to operate the local system will be supplied from the Huntsville plant.

MOUNTAIN HOME, ARK.—The Zinc & Iron Ore Company, recently organized, it is reported, proposes to construct a hydroelectric development on the North Fork River and build smelters.

LAVERNE, OKLA.—Arrangements are being made by the City Council for the installation of a municipal electric-light plant, for which $13,000 in bonds were recently voted.

MIAMI, OKLA.—Preliminary steps will be taken at once by the City Commissioner to start work on extensions and improvements to the municipal electric-lighting system, involving an expenditure of about $45,000.

WEWOKA, OKLA.—The installation of an electric-lighting plant is under consideration by the City Council.

BRYAN, TEX.—The City Commission has adopted an ordinance authorizing the city manager to purchase additional transformers for the light and power systems. The privilege of erecting an electric line beyond the city limits to connect with the city system has been granted by the City Commission.

DEL RIO, TEX.—The construction of a series of dams across Devil's River to provide for water storage for irrigating large areas of land is being promoted by Charles A. Lindsay of Wichita, Kan., and associates. It is also proposed to install one or more hydroelectric plants in connection with the irrigation project.

EAGLE PASS, TEX.—J. R. Sanford and associates are planning to install two centrifugal pumps of 75 hp. each, driven by electric motors, for the purpose of pumping water to irrigate 2000 acres of land about 7 miles from Eagle Pass.

SAN ANGELO, TEX.—The Interstate Electric Corporation is planning to extend its electric transmission lines to a number of towns in Western Texas in addition to those that are already being served. The line which now runs from San Angelo to Ballinger will be extended to Coleman and Brownwood.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 4 for the erection of telephone and power transmission lines at the navy yard, Puget Sound. Drawings and specifications (No. 2805) may be obtained on application to the above bureau or to the commandant of the navy yard named.

TACOMA, WASH.—Surveys of four sites tributary to the Nisqually River are being made by Llewellyn Evans, superintendent of the city lighting plant, for an additional power plant to develop 17,000 hp. The cost is estimated at $1,000,000.

BAKER, ORE.—The electric transmission line of the Idaho-Oregon Light & Power Company, extending from Homestead on the Snake River to Pine Valley, has been completed and is serving electricity for lamps and motors in the towns of Halfway, Carson, Langrell and Cornucopia. The company is also erecting a line into Eagle Valley to furnish electricity in the towns of Richland and New Bridge.

EUGENE, ORE.—Improvements to the flume and forebay at the municipal electric generating plant at Walterville is under consideration by the Water Board. C. W. Geller is secretary and general superintendent.

GOLD HILL, ORE.—The placer mining property known as the Hydraulic Mining Company's mine has been purchased by W. A. Sharp of Grants Pass, and brother, L. S. Sharp. The new owners, it is said, will install hydro-electric precipitating value-recovering mining machinery.

McMINNVILLE, ORE.—The installation of the new street-lighting system, consisting of 75 series incandescent lamps of 75 cp., is nearly completed. P. E. Thornton is superintendent.

SALEM, ORE.—Two applications have been filed with the state engineer for power developments on the Deschutes River by H. S. McGowan of McGowan, Wash., who is identified with P. J. McGowan & Sons, large salmon packers. One is for an appropriation of 4500 cu. ft. of water of the Deschutes River at a point known as the reclamation power site in Sherman and Wasco Counties. It is proposed to construct a dam 118 ft. high and 300 ft. long at the bottom and 800 ft. at the top, to cost approximately $2,000,000. The other application is for an appropriation of 3500 cu. ft. per second of water of the Deschutes River at the Metolius power site in Jefferson County, where it is proposed to build a dam 236 ft. high, 90 ft. long at the bottom and 420 ft. long at the top. The cost is estimated at $4,000,000.

ALPAUGH, CAL.—The new substation of the San Joaquin Light & Power Company, which is to supply electricity to operate the pumps for irrigating 8000 acres in the Alpaugh Irrigation district, has been completed. The substation is equipped with three 500-kw. transformers and is supplied with electricity from the Corcoran generating station.

EL SEGUNDO, CAL.—The City Council has granted the Southern California Edison Company a franchise to erect electric transmission lines, conduits, cables, etc., for the distribution of electricity in El Segundo for a period of 40 years.

FRESNO, CAL.—The Board of Trustees has awarded the contract for installing 118 electroliers on Fresno Avenue from G to A and from A on Kearney Boulevard to Tehama to the Lewis Electric Company of Fresno.

LOS ANGELES, CAL.—Plans are being prepared by the Pacific Electric Railway Company of Los Angeles for the construction of 14 new shop buildings, including machine shops and forge works at Torrance. The total cost is estimated at about $1,000,000.

OLIVE, CAL.—Steps have been taken by the Olive Improvement Association for establishing the Olive lighting district.

RICHMOND, CAL.—The installation of an ornamental street-lighting system is under consideration by the Richmond Retail Merchants' Association.

SAN DIEGO, CAL.—A petition has been filed with the Board of Supervisors asking for the formation of a public highway lighting district, to be known as the Sierra Vista public highway.

WOODLAND, CAL.—The Pacific Gas & Electric Company contemplates extending its electric transmission lines to Guinda, Rumsey and Brooks.

YOSEMITE, CAL.—The Treasury Department at Washington has petitioned Congress for authority to use $5,000 of the revenues of Yosemite National Park to complete the new hydroelectric power plant in the park.

KENDRICK, IDAHO.—The Potlach Consolidated Electric Company has placed orders for copper wire to replace the iron wire for the electric transmission line between Kendrick and Troy. The company is now installing three new transformers at its Troy station. A. Wilmot is president.

GOLD HILL, UTAH.—Frank W. Ferris of Gold Hill, it is reported, is building a power plant on Trout Creek, about 48 miles from Gold Hill, to cost between $40,000 and $50,000. Electricity generated at the plant will be used at the mines in the Gold Hill, Clifton, Willow Springs, Fish Springs, Ferber and other mining districts.

SALT LAKE CITY, UTAH.—Application has been made to the State Engineer by Joseph Lippman and Henry Strauss for water rights in the north and west forks of the Duchesne River near Stockton. The plans filed provide for a hydroelectric development of about 12,000 hp. Electricity generated at the plant will be transmitted to Salt Lake City over a high-tension line.

KINGMAN, ARIZ.—The Desert Power & Water Company is planning to erect an electric transmission line to Hackberry and another line extending to Cyclopic mine, 30 miles north of Chloride. The cost of both lines is estimated at about $90,000.

MALTO, MONT.—Arrangements are being made for the installation of a new generator in the local electric-light plant, which has already been purchased.

EUREKA, NEV.—Handley Brothers, it is reported, have decided to erect a power sheep-shearing plant (to cost about $3,000) at the Charley Minoletti ranch, about 9 miles north of Eureka.

LAMOILLE, NEV.—The Elko-Lamoille Power Company is contemplating improvements to its local system. The proposed work includes the construction of a new reservoir and piping the waters of the west fork of the stream into it with a pipe line 5000 ft. long.

LAS CRUCES, N. M.—Formal application will soon be made to the United States government for the advancement of $2,000,000 to be used in the construction of an irrigation canal that is to lead from the diversion dam of the Elephant Butte reclamation project at Leasburg to Montoya, and for the installation at the latter place of a large hydroelectric plant. All money required for the proposed work is to be repaid by the project. The proposed hydroelectric plant is to provide power for operating industries and to supply energy in El Paso, Las Cruces and other towns along the transmission line.

ROSWELL, N. M.—The Roswell Gas & Electric Company is installing two 256-hp. Erie vertical boilers with Erie stokers, two boiler-feed pumps, with heaters and all auxiliaries, a 1200-sq. ft. surface condenser on Allis-Chalmers engine, erecting a steel stack, 150 ft. high, 6 ft. in diameter, and also moving and raising three 200-hp. Babcock & Wilcox boilers for stokers. C. M. Einhart is secretary.

Canada

CHILLIWACK, B. C.—The cost of reconstruction of the telephone lines of the Chilliwack Telephone Company, recently damaged by storms, is estimated at $19,500.

PORT MOODY, B. C.—The construction of a new rolling mill on Rocky Point is under consideration by the Port Moody Steel Works. The equipment will include a 6-ton, three-phase electric furnace.

WINNIPEG, MAN.—Tenders, it is reported, will be asked by the Provincial Bridge Commission for lamp standards and for furnishing electricity for lamps and motors required for the bridge, which will be completed about June 1.

BASSANO, ONT.—The purchase of an electrically-driven pumping unit is under consideration by the Waterworks Department.

BEETON, ONT.—Debentures to the amount of $15,000 have been authorized for the installation of a hydroelectric system in Beeton.

BRADFORD, ONT.—Plans are being considered for the installation of a hydroelectric system in Bradford, for which $15,600 in debentures has been authorized.

GUELPH, ONT.—Steps, it is reported, have been taken for the development of the unused power on the Speed River. R. H. Clemens, district representative, it is reported, has taken the matter up with the Hydro-Electric Commission and an inspection will soon be made.

LEAMINGTON, ONT.—Negotiations are under way between the Essex County Light & Power Company and the Hydro-Electric Power Commission of Ontario whereby the latter will take over the plant and system of the former.

MERRITTON, ONT.—Tenders, it is reported, will be asked for the construction of a power plant for the Riordan Pulp & Paper Company. The head office of the company is at 355 Beaver Hall Square, Montreal, Que.

NEWBORO, ONT.—The ratepayers have approved a by-law awarding a contract to J. P. Tett & Brothers to supply electricity in Newboro. Energy to operate the system will be obtained from Bedford Mills.

PORT COLBORNE, ONT.—The Town Council is considering the construction of a water-works pumping station and equipment.

TOTTENHAM, ONT.—Arragnements are being made for the installation of a hydroelectric system in Tottenham, for which $9,000 in debentures has been authorized.

COLERAINE, QUE.—The contract for the entire electrical equipment of the Bennett-Martin Asbestos & Chrome Mines, Ltd., has been awarded to the Canadian General Electric Company.

COLERAINE, QUE. — The contract for wire for the erection of an electric transmission line between the Black Lake station of the Shawinigan Water & Power Company and the Bennett-Martin Asbestos & Chrome Mines, Ltd., has been awarded to the Canadian Wire & Cable Company, and for insulators to the Canadian Porcelain Company of Hamilton.

MONTREAL, QUE.—The Montreal Tramways Company, under the terms of the new 35-year franchise, has been instructed to construct double tracks on about 13 miles of new line. The work is to be begun in June and completed by November.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 26 for furnishing bronze, copper, copper and brass tubing, steam traps, Klaxon signals, electric grinders, arc lamps, globes, reflectors, power hack saw, copper cable, etc. Blanks and information relating to this circular (No. 1200) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

HONOLULU, HAWAII. — Preparations are being made by the Hawaiian Electric Company for the construction of a new electric plant, to be located on Allen Street, between Bishop and Alekea Streets. The cost of the building exclusive of equipment is estimated at about $300,000.

Record of Electrical Patents

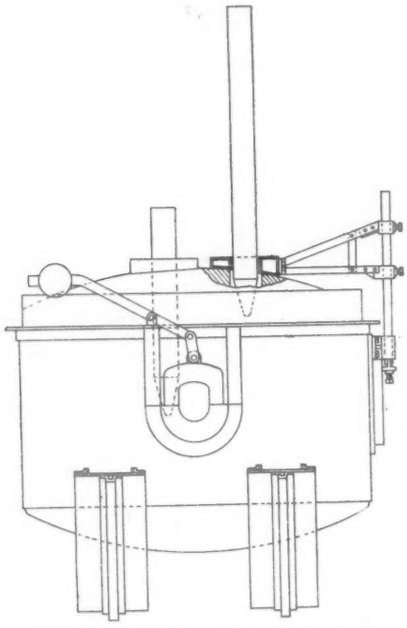
Notes on United States Patents

(Issued Jan. 15, 1918.)

1,253,736. INSULATOR; Ferdinand Siebee, Charlottenburg, Germany. App. filed July 15, 1914. "Sleeve" insulators for transformer leads carrying currents at very high voltages.

1,253,788. ELECTRIC LOCKING DEVICE; Floyd J. Collar, Alameda, Cal. App. filed July 1, 1916. Permutation-lock-controlled switch especially adapted for insertion in the ignition system of internal-combustion engines.

1,253,807. AUTOMATIC SIGNALING MECHANISM FOR STARTING ELEVATORS; Allen A. Fuller, Birmingham, Ala. App. filed Aug. 13, 1915. For starting and controlling the movement of a battery of elevators.



1,254,510—Water Jacket for Electric Furnace Electrodes

1,253,818. TAPE-TRANSMITTING APPARATUS FOR TRANSMITTING ELECTRICAL IMPULSES; Henry Kingsford, Westminster, London, England. App. filed June 7, 1915. Improvements.

1,253,846. COMBINATION CASE FOR FLASHLIGHTS; Anker S. Lyhne, Bridgeport, Conn. App. filed Oct. 19, 1915. Improvements.

1,253,873. WIRELESS RECEPTACLE; Henry T. Paiste, Philadelphia, Pa. App. filed July 24, 1913. Provides a novel form of lamp or plug receptacle which, in addition to being of relatively simple and substantial construction, shall have the connections between its various terminals made of permanently mounted strip metal pieces to the exclusion of wires.

1,253,874. ATTACHMENT PLUG; Henry T. Paiste, Philadelphia, Pa. App. filed July 24, 1913. Adapter or connecting device for interposition between a socket.

1,253,885. ELECTRICAL EXERCISING DEVICE; Alfredo Quinones, New Orleans, La. App. filed March 24, 1917. Improved.

1,253,915. ELECTRIC HEATING ELEMENT; Clifford R. Wassell, Chicago, Ill. App. filed May 3, 1916. Improved.

1,253,983. BRACKET FOR ELECTRIC LAMPS OR THE LIKE; Adolph W. Kuebler, Chicago, Ill. App. filed July 26, 1915. Improvement.

(Issued Jan. 22, 1918.)

1,254,034. COMBUSTION-ENGINE LOCOMOTIVE; Rudolf A. Furrer, Winterthur, Switzerland. App. filed Aug. 17, 1916. The combustion-engine plant is divided, with its two parts or halves in parallel and the shaft of the driven electric generator connected between them, instead of having the generator coupled in line with the engine as is usual with undivided power plants.

1,254,038. RAILWAY SIGNALING; Henry W. Griffin, New York, N. Y. App. filed July 31, 1912. Improvements.

1,254,045. ELECTROLYTIC APPARATUS; James T. King, Toronto, Ont., Canada. App. filed April 19, 1917. Improvements.

1,254,046. MECHANICAL PLATING MACHINE; Willis R. King, Newark, N. J. App. filed April 16, 1917. For plating articles in bulk.

1,254,056. PROCESS OF MAKING METAL POWDER; William C. Moore, Lakewood, Ohio. App. filed July 29, 1915. Relates to the making of metal powders and also to current-collecting brushes made from the same.

1,254,067. ELECTRIC SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed June 23, 1917. Entrance switch.

1,254,077. ELECTRIC FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed Jan. 19, 1914. Tilting.

1,254,079. ELECTRIC SMELTING FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed March 1, 1917. Improved ore feed adapted for use in connection with smelting furnaces.

1,254,080. ELECTRODE HOLDER; Frederick T. Snyder, Oak Park, Ill. App. filed Sept. 19, 1917. Applies particularly to side holders.

1,254,081. TELEPHONE SYSTEM; Franklin A Stearn, Paterson, N. J. App. filed July 5, 1916. Type in which automatic switches are employed for distributing to a plurality of operators' positions the calls originated by the telephone lines of the exchange.

1,254,083. MEASURE-SERVICE TELEPHONE SYSTEM; Samuel S. Stolph, Chicago, Ill. App. filed Feb. 29, 1912. Applies particularly to a party line.

1,254,114. PORTABLE ELECTRIC LIGHT; Bernard Benedict, New York, N. Y. App. filed June 14, 1917. Tubular type.

1,254,117. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed Aug. 18, 1917. Systems wherein signals may be either transmitted from or received at the same station.

1,254,118. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed Aug. 18, 1917. Telephone.

1,254,122. SWITCH-OPERATING MECHANISM; Roy V. Collins, West Newton, Mass. App. filed March 9, 1915. Permits the electric motor for operating the switch point to be put in a sealed box in the ground, since it avoids the making of arcs in the motor box.

1,254,135. ADJUSTMENT OF RELAY CONTACT FINGERS; Clinton C. Harrington, Swissvale, Pa. App. filed Sept. 11, 1917. Improvements.

1,254,139. RAILWAY SIGNALING SYSTEM AND RELAY ADAPTED FOR USE THEREIN; John S. Holliday, Wilkinsburg, Pa. App. filed June 22, 1916. Improvements.

1,254,146. SIGNALING CIRCUIT; William H. Martin, New York, N. Y. App. filed Aug. 27, 1917. Telephone.

1,254,152. ELECTRIC SIGNAL SYSTEM; James D. Nelson, Cincinnati, Ohio. App. filed Feb. 26, 1917. Produces a signal system in which the resistance of the controlling magnets of the device to be supervised is normally out of the circuit until momentarily introduced therein upon actuation of any one of the supervised devices.

1,254,167. TELEPHONE-EXCHANGE APPARATUS; Charles A. Stickney, Chicago, Ill. App. filed May 15, 1916. Means whereby a coin deposited in a coin box will be under control of the subscriber depositing the coin until the party called has answered the control of the coin then passing from the subscriber automatically.

1,254,168. TELEPHONE-COIN BOX; Charles A. Stickney, Chicago, Ill. App. filed May 15, 1916. Means whereby the subscriber depositing a coin maintains control of the coin until the connection called for by him is completed.

1,254,172. ELECTRIC CONNECTOR; Frederick A. Tefft, Toledo, Ohio. App. filed May 21, 1917. Used to connect a lead line to a battery terminal.

1,254,182. IGNITION SYSTEM; Leo J. Werner, Newark, N. J. App. filed May 29, 1917. Overcomes the difficulty of hard starting by providing means of obtaining a spark or shower of sparks at the proper time, no matter how slow the rotative speed of the engine is.

1,254,198. SIGNAL ALARM FOR SWITCHES; Gabor Bicsi, Gary, W. Va. App. filed Dec. 19, 1916. Combines with the movable portion of a switch rail means whereby to notify the switchman or other workman when the switch is in open position.

1,254,210. ELECTRIC LIGHT FIXTURE; John H. Dale, New York, N. Y. App. filed April 3, 1915. For use with nitrogen-filled lamps.

1,254,221. ALTERNATING-CURRENT MOTOR; Valere A. Fynn, St. Louis, Mo. App. filed Feb. 14, 1917. Constitutes the motor itself so as to make it possible to derive from its primary the direct current necessary for the speed regulation of the machine.

1,254,223. LOW-VOLTAGE ELECTRIC SWITCH; Monroe Guett, Hartford, Conn. App. filed June 22, 1917. Automobile.

1,254,242. DIRECTION INDICATOR; Howard J. Lambert, Portland, Ore. App. filed Nov. 18, 1914. Automobile.

1,254,254. INDICATING SYSTEM; William H. Matthies, Hackensack, N. J. App. filed Dec. 29, 1916. Provides an improved arrangement for testing senders.

1,254,265. BELL; Victor W. Page, Bristol, Conn. App. filed Nov. 16, 1911. Motor-driven gongs.

1,254,274. EXPANDING DEVICE FOR SPECTACLE RIMS; George E. Pryor, Los Angeles, Cal. App. filed March 6, 1916. Of the class generally known as composition rims.

1,254,288. CABLE TESTER; Christopher D. Stewart, Ottawa, Ill. App. filed June 22, 1916. Improvements.

1,254,290. TELEPHONE METER-SERVICE SYSTEM; Harold D. Stroud, Chicago, Ill. App. filed April 3, 1913. Meter which, instead of registering the number of calls, registers the total time during which the telephone is in use.

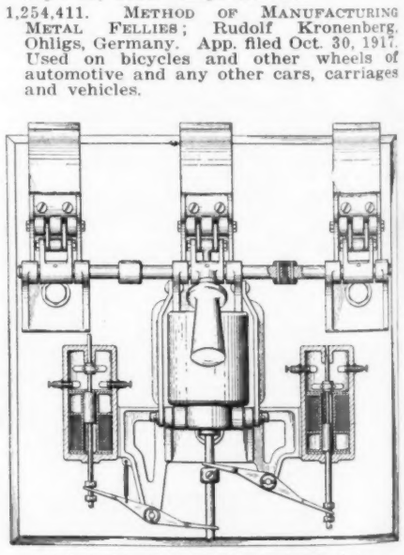
1,254,308. METALLURGICAL FURNACE; William Buhl, Carnegie, Pa. App. filed Aug. 20, 1917. Electric type.

1,254,330. SOUND-RECORDING AND REPRODUCING MACHINE; David F. McQuire and Kenneth D. McQuire, Hornchurch, England. App. filed June 1, 1917. Adapted for domestic and office use.

1,254,331. ELEVATOR SIGNAL SYSTEM; Alexis Le Blanc, New York, N. Y. App. filed April 16, 1913. Improvements.

1,254,405. ELECTRIC HORN SWITCH; Edward E. Johnson, St. Paul, Minn. App. filed Sept. 21, 1914. Improvements.

1,254,411. METHOD OF MANUFACTURING METAL FELLIES; Rudolf Kronenberg, Ohligs, Germany. App. filed Oct. 30, 1917. Used on bicycles and other wheels of automotive and any other cars, carriages and vehicles.



1,254,534—Remote-Control Electric Switch

1,254,416. ENGINE-TROUBLE DETECTOR; Samuel Lazarus, Cleveland, Ohio. App. filed Oct. 18, 1915. Particularly adapted for use with an engine having six or a less number of cylinders.

1,254,510. WATER JACKET FOR ELECTRIC FURNACE ELECTRODES; Harold J. Kitchen, Luton, England. App. filed March 7, 1917. Improvements.

1,254,534. REMOTE-CONTROL ELECTRIC SWITCH; Charles E. Pelletier, New Orleans, La. App. filed Feb. 2, 1915. Improved.